

AAI AUTOMOTIVE INDUSTRIES

**AUTOMOTIVE and AVIATION MANUFACTURING
ENGINEERING • PRODUCTION • MANAGEMENT**

FEBRUARY 1, 1955

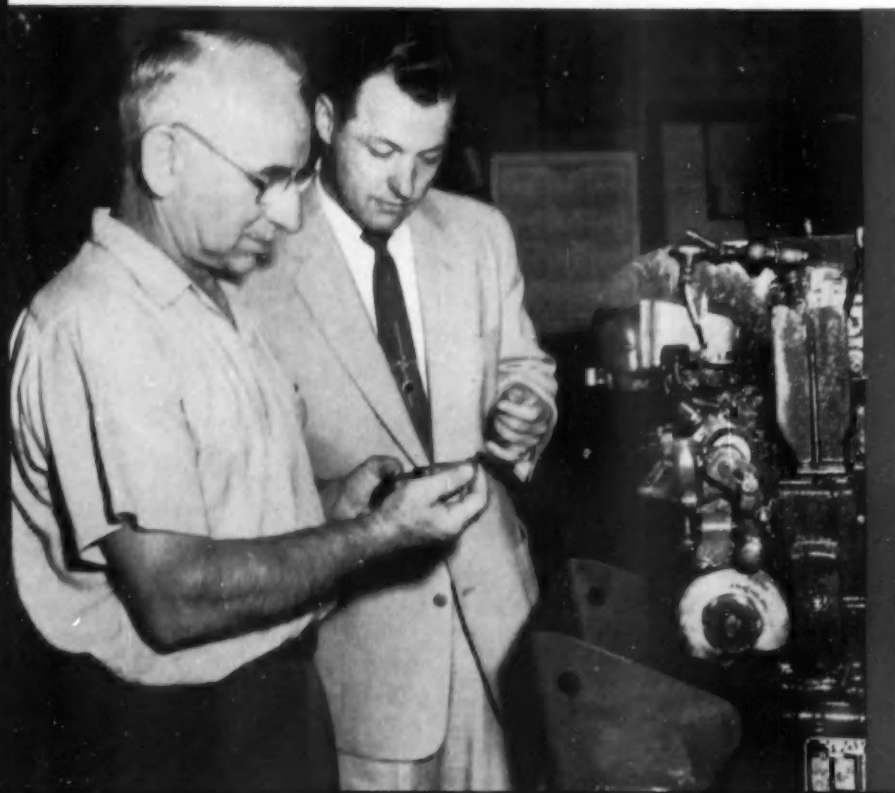
In This Issue

**Engine Ratings in Horsepower and Torque
Complete Cycle of Making Car Torsion Bars
Precision Heat Treating Aircraft Gears
Motor Driven Engines on the Assembly Line
First of SAE Golden Anniversary Meetings
Coaxial Power Steering Gear Production**

COMPLETE TABLE OF CONTENTS, PAGE 3

A C H I L T O N P U B L I C A T I O N

The story of 5 benefits Wayne Screw Products gets from using STANICUT CUTTING OIL



Plant Foreman Al Ziegman (left) and Standard industrial lubrication specialist L. J. Loomis examine pitch diameter of screw threads. L. J. Loomis' engineering background plus his field experience in industrial lubrication, customers find, pays off for them. Lee is a graduate of Tri-State college of Indiana with a B.S. degree. Before entering field work, he completed Standard Sales Engineering School.

STANICUT 137 BC Oil solved finish problem for Wayne Screw Products Company, gave better finish on screw and machined parts like these—plus four other important benefits.

Management at Wayne Screw Products Company, Detroit, found they were not getting a completely satisfactory finish on aircraft quality stainless steel, which the plant was machining. They followed a suggestion made by their Standard Oil lubrication specialist to switch to STANICUT 137 BC Oil. The result: five benefits. (1) Better finish (2) Higher quality work (3) Longer tool life (4) Higher production because of less down time for tool sharpening and adjusting (5) Cutting oil costs reduced approximately 50%.

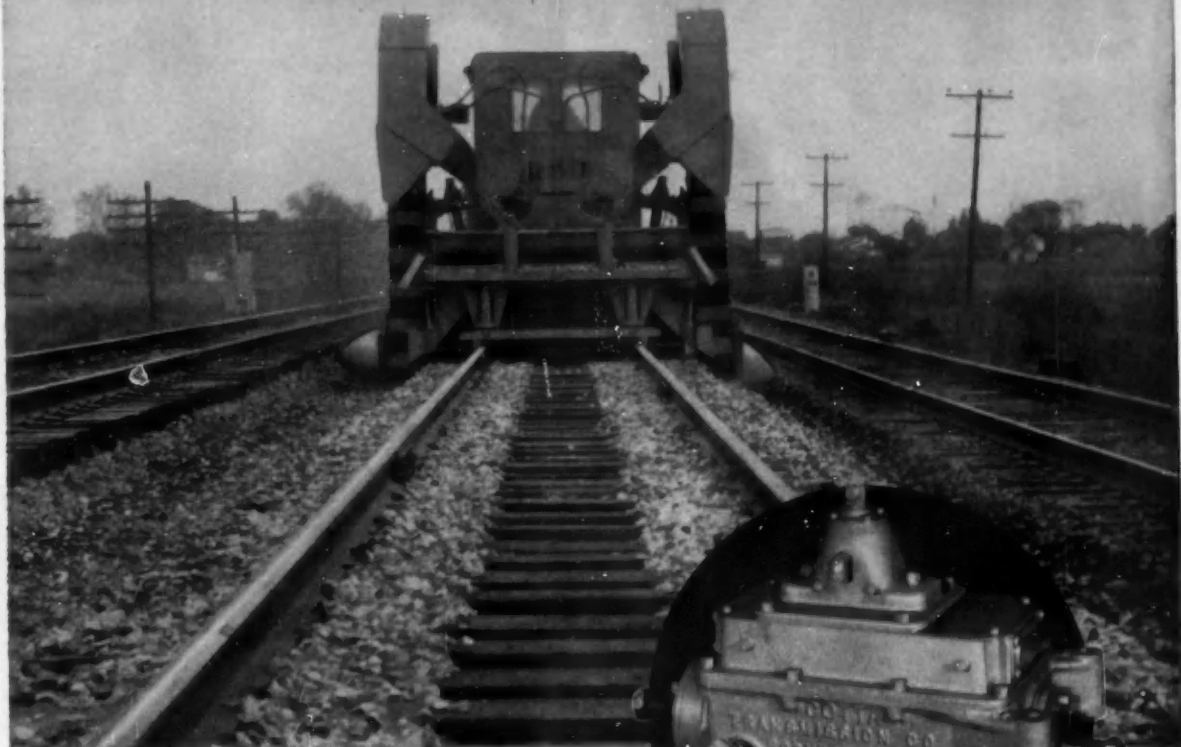
At first STANICUT 137 BC Oil was used in two automatic screw machines—a National Acme Multi-Spindle and a Brown & Sharp Single Spindle. Production benefits prompted Wayne Screw Products to convert other equipment to STANICUT 137 BC Oil—and with similar results.

Delivering benefits like this is an old story for STANICUT 137 BC Oil. A Standard Oil lubrication specialist will be happy to demonstrate how Standard's cutting oils can perform with similar results for you. In the midwest, a call to your nearby Standard Oil office will bring a prompt response. Or contact: Standard Oil Company, 910 South Michigan Avenue, Chicago 80, Illinois.



STANDARD OIL COMPANY
(Indiana)

Ballast distributor brings automation to track maintenance!



Courtesy — Railway Maintenance Corporation

COTTA TRANSMISSIONS

used for added stamina

Look at the way track maintenance is mechanized today!

This McWilliams ballast distributor, manufactured by Railway Maintenance Corporation, Pittsburgh, Pa., distributes the proper amount of ballast for any desired track raise . . . picks up ballast from inter-track space and shoulder, and deposits it behind the machine, both inside and outside track, in perfect position for tamping.

Self-powered and one-man controlled, the machine operates at 800 to 1200 ft. per hour . . . requires

a rugged, dependable transmission for continuous trouble-free operation. Cotta Heavy-Duty Transmissions were selected because they're precision-engineered and skillfully assembled by specialists with long experience and "know-how" in manufacture of heavy-duty power transmissions.

If you build cranes, locomotives, drillers, shovels, pumps, or other heavy-duty equipment, and you need a standard or "engineered-to-order" transmission — input torque ranging from 150 to 2500 ft. lbs. — see Cotta first!



COTTA

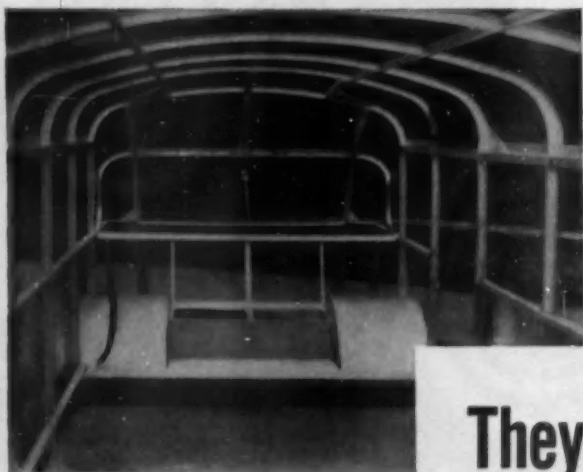
HEAVY-DUTY TRANSMISSIONS

"Engineered-to-order"

THIS INFORMATION WILL HELP YOU

Diagrams, capacity tables, dimensions, and complete specifications sent free on request. Just state your problem—COTTA engineers will help you select the right unit for best performance. May we work with you?

COTTA TRANSMISSION CO., ROCKFORD, ILLINOIS



1300-pound weight saving means less wear on tires and brakes, less fuel and maintenance for this 25-passenger type bus body made by Boyertown Auto Body Works, Boyertown, Pa.



Resistant to corrosion, abrasion and impact, nickel alloy steels extend life of 17 basic bodies and more than 100 custom variations put out by Boyertown Auto Body Works.

They Haul more...yet weigh less



50% greater yield strength in sections of $\frac{3}{4}$ " or less, and up to 40% more ultimate strength permit Boyertown to trim about 500 pounds from this type of parcel delivery truck, as compared with carbon steel.



The interior of Boyertown's food-handling trucks is lined with stainless chromium-nickel steel for its corrosion-resistance which assures sanitation.

You, too, can trim needless weight from truck bodies, while adding strength, toughness and corrosion-resistance

Use of high strength, low alloy steels containing nickel is the answer

You can lower haulage costs by designing to utilize high strength, low alloy steels containing nickel.

Several leading steel companies offer these steels. Look for such trade names as Tri-Ten, Cor-Ten, Mayari R, Yaloy, Hi-Steel, Double-Strength, and Dynalloy.

Get all the facts shown in "Nickel-Copper High Strength, Low-Alloy Steels . . ." a manual that is yours for the asking.

It discusses design factors that help

you cut weight without sacrificing safety. It explains why these nickel alloy steels provide superior resistance to atmospheric and many other types of corrosion. It describes their behavior in fabrication, as well as applications that illustrate how they may help you improve products or equipment.

Take full advantage of the properties these nickel alloy steels offer . . . write for your copy of "Nickel-Copper High Strength, Low-Alloy Steels" now.



THE INTERNATIONAL NICKEL COMPANY, INC. 67 WALL STREET NEW YORK 5, N.Y.

A CHILTON MAGAZINE

PUBLISHED SEMI-MONTHLY

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AUTOMOTIVE INDUSTRIES

FEBRUARY 1, 1955

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As part of its worldwide automotive and aviation news coverage, AUTOMOTIVE INDUSTRIES is serviced by International News Service and has editorial correspondents in major United States and foreign industrial centers.

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MEMBER



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Publications, Inc.



Audit Bureau
of Circulations

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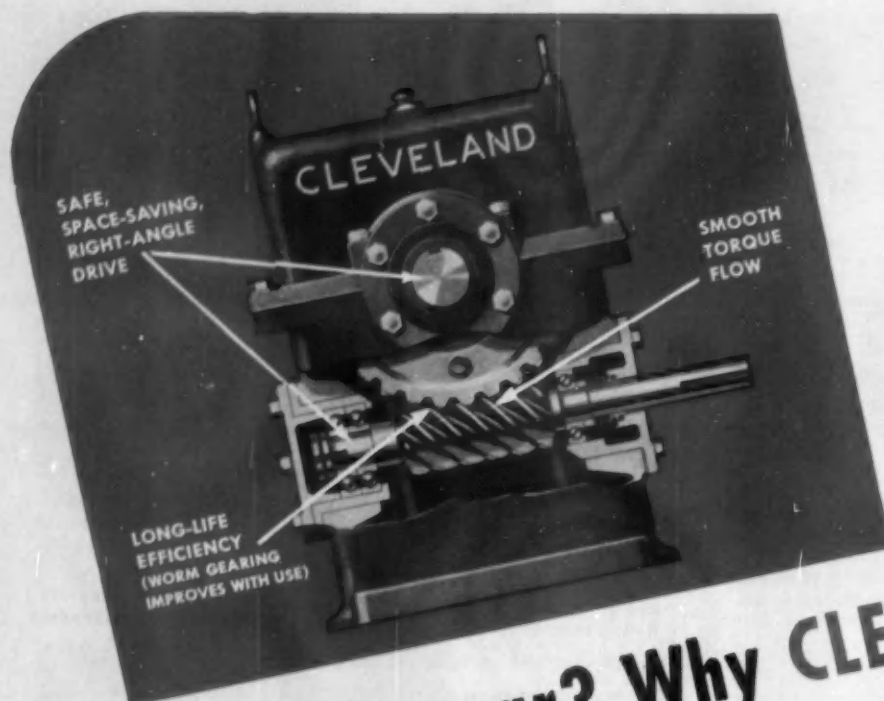
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AUTOMOTIVE INDUSTRIES, February 1, 1955

3



Cutaway shows compact interior design and construction of a typical Cleveland worm gear speed reducer, used in thousands of plants. Clevelands save floor space—are simple to install and maintain. A minimum number of moving parts practically eliminates trouble.

Why WORM gear? Why CLEVELAND?

HERE are some of the inside reasons why Cleveland worm gear speed reducers are specified by many of the leading builders and users of industrial machinery.

- **SAFE, SPACE-SAVING, RIGHT-ANGLE DRIVE**—Cleveland's are compact, provide a wide range of reduction speeds. Worm and gear enclosed in sealed housing replace dangerous open gearing, belts and pulleys. Safety always for machine operators and lube men! Gearing runs in oil bath, insures positive lubrication, eliminates oil cans and grease paddles.
- **SMOOTH TORQUE FLOW**—By virtue of the sliding action of worm on gear, a Cleveland transmits power uniformly and smoothly. Constant angular velocity assures positive control of work on driven machine.
- **LONG-LIFE EFFICIENCY**—Experience demonstrates that Cleveland case-hardened worms and nickel-bronze gears actually improve with use. Even operating under continued, severe overloads, danger of sudden failure is remote. Thousands of Clevelands operate for the life of driven machines.

Get the complete Cleveland story by writing for new Catalog 400 today. The Cleveland Worm & Gear Company, 3274 East 80th Street, Cleveland 4, Ohio.

Affiliate: The Farval Corporation, Centralized Systems of Lubrication. In Canada: Peacock Brothers Limited.



CLEVELAND

Worm Gear

Speed Reducers

EATON

Zero-Lash



HYDRAULIC VALVE LIFTERS

Provide Important Advantages

- ★ Silent valve train operation
- ★ Longer life for valves and seats
- ★ Elimination of lash worries for the life of the engine
- ★ Improved idling
- ★ Permit cam design for optimum engine operating efficiency at all speeds and all operating temperatures



Eaton Hydraulic Valve Lifters are available in all designs and face materials to meet the specific requirements of each application. Let our engineers work with yours.

EATON

— SAGINAW DIVISION —
MANUFACTURING COMPANY
9771 FRENCH ROAD • DETROIT 13, MICHIGAN
General Offices: CLEVELAND, OHIO

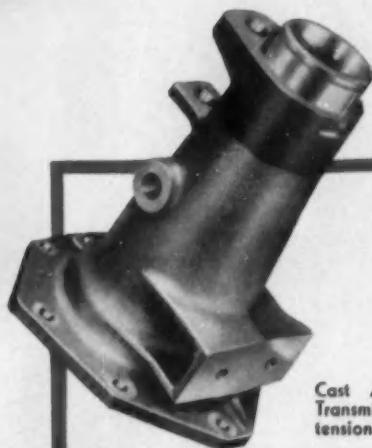


PRODUCTS: Sodium Cooled, Poppet, and Free Valves • Tappets • Hydraulic Valve Lifters • Valve Seat Inserts • Jet Engine Parts • Rotor Pumps • Motor Truck Axles • Permanent Mold Gray Iron Castings • Heater-Defroster Units • Snap Rings • Springtites • Spring Washers • Cold Drawn Steel • Stampings • Leaf and Coil Springs • Dynamatic Drives, Brakes, Dynamometers

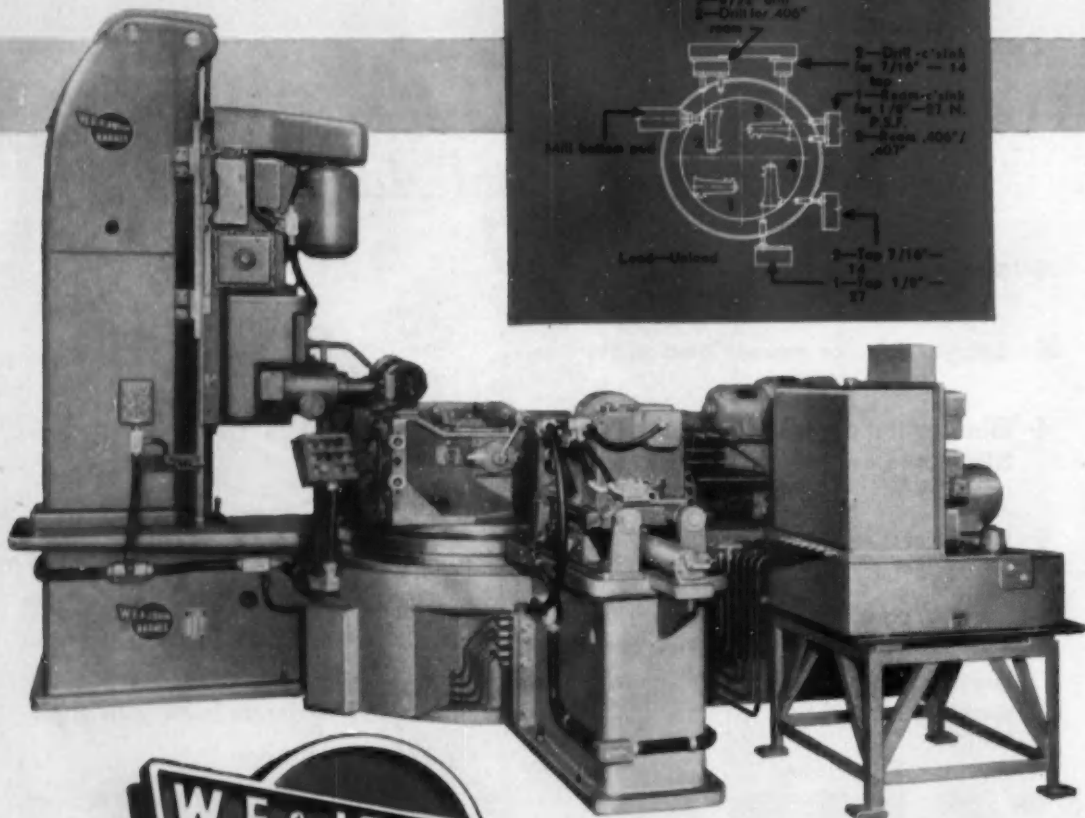
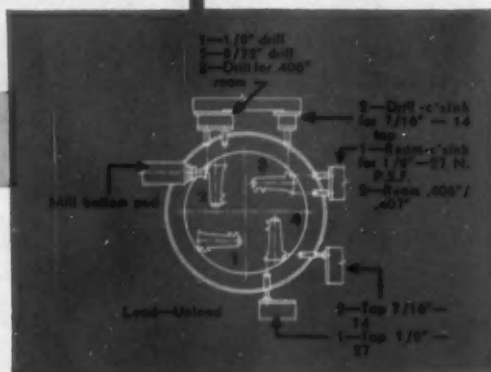
118 Pieces per hour 35 Operations....

TRANSMISSION EXTENSIONS MACHINED TO CLOSE TOLERANCES ON COMPANION UNITS

Here is another typical example of how W. F. & John Barnes coordinated special machine engineering and building service helps solve complex machining problems. These two companion units, designed to machine cast aluminum automobile transmission extension housings, reduce production costs by combining operations. Note how the parts are positioned and the tooling arranged for efficient machining, and how the over-all design conserves floor space. The two machines perform 35 operations at the required gross production rate of 118 pieces per hour. Whether your production requires large or small machines, you'll find the coordinated services at Barnes can help you solve problems quickly and efficiently.



Cast Aluminum
Transmission Ex-
tension Housing

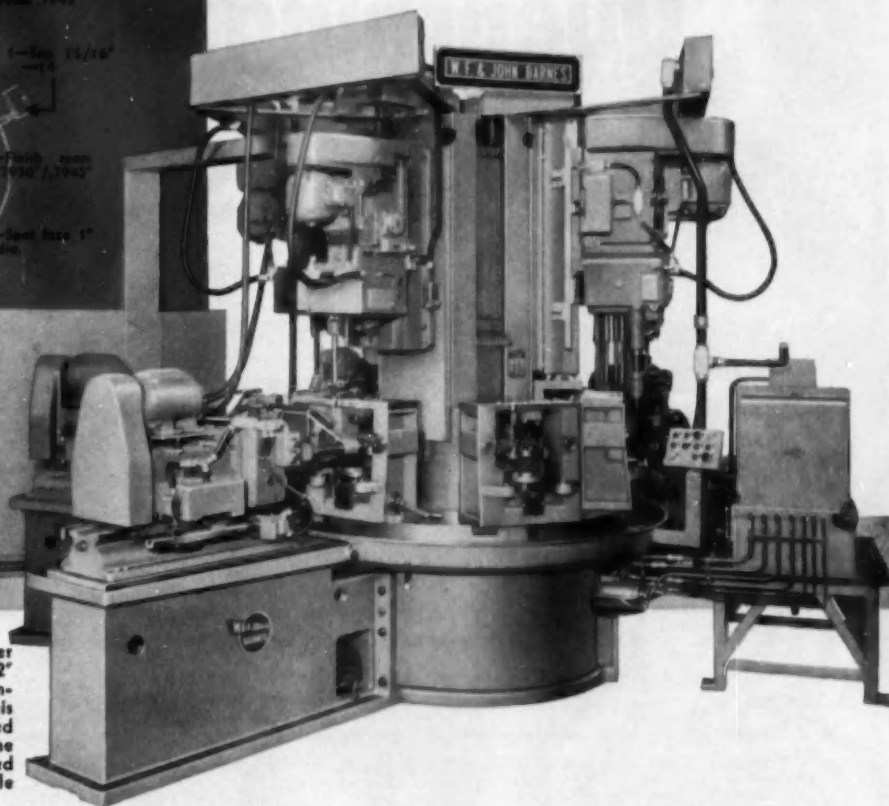
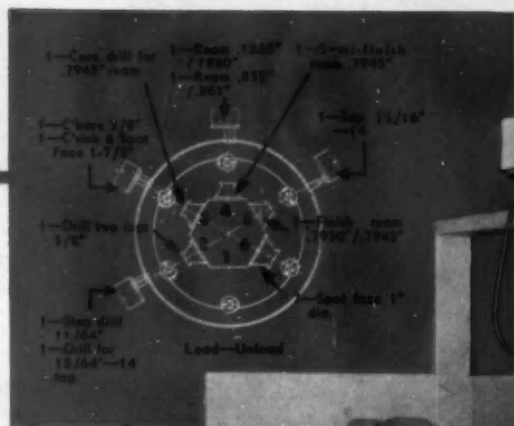


Barnes 4-Station Special Machine with 48" diameter hydraulically operated rotating table. This unit performs 17 operations. Vertical milling of bottom pad in Station No. 2 is completed with a retracting spindle. Fixtures locate part on end bores.

MULTIPLE SPINDLE

W. F. & JOHN BARNES COMPANY
DRILLING • BORING • TAPPING MACHINES

... ON W. F. & JOHN BARNES SPECIAL MACHINES



► Barnes 6-Station Center Column Machine, with 72" diameter indexing table, completes 18 operations. On this unit the work-piece is located from the shoulder opposite the flange end, and positioned radially from a reamed hole in the flange.

BARNES SPECIAL MACHINE TOOL BUILDING SERVICE INCLUDES

1 SPECIALIZED MANUFACTURING FACILITIES—75-year background, large well equipped plant efficiently tooled to produce high production machines.

2 SPECIAL HYDRAULIC EQUIPMENT—designed and built to meet JIC standards. Individually engineered units assure smooth, dependable actuation for every requirement.

3 SPECIAL ELECTRICAL EQUIPMENT and CONTROLS—individually designed and built for maximum safety and ease of control with circuits that assure the most dependable coordination of all machine functions.

4 SPECIAL GAUGES, FIXTURES, TOOLS—designed for each individual machining problem, assure accuracy of operations at high production speeds.

5 SPECIAL HANDLING AND CONVEYOR EQUIPMENT—designed and built to reduce work handling, effect maximum safety and efficiency.

6 COORDINATED DESIGN AND ENGINEERING—Mechanical, Hydraulic, Electrical, Process, Tool, and Fixture Engineers work together at Barnes. Team-work solves complex problems quickly.

Write FOR FREE DATA

"Coordinated Machine Engineering"—a free booklet describing modern machines and mass production techniques. Write for your copy today.



403 S. WATER ST., ROCKFORD, ILLINOIS

AUTOMATIC PROGRESS-THRU AND TRANSFER TYPE MACHINES

Quenching Media for Alloy Steels

This is the seventh of a series of advertisements dealing with basic facts about alloy steels. Though much of the information is elementary, we believe it will be of interest to many in this field, including men of broad experience who may find it useful to review fundamentals from time to time.

In the quenching of alloy steels, several points require consideration, among them being the size and shape of the piece, the type of steel involved, the quenching medium, and proper agitation of the quenching bath.

The composition of the steel has an important bearing on the selection of a quenching medium. As an example: shallow-hardening steels require a fast cooling rate, whereas deeper-hardening steels require progressively slower rates as the alloy content increases.

Three commonly used types of quenching media for alloy steels are water, oil, and air. These are discussed below in the order of quenching severity:

(1) WATER. Fresh water is entirely satisfactory only when used as a flush. Salt-water solutions are generally used in still baths to avoid the bad effect of bubbles resulting from dissolved atmospheric gas. It should be noted that the quenching rate drops as water temperature is increased. The range of 70 deg to 100 deg F is recommended.

(2) OIL. An oil quench cools more slowly than water, and faster than air. Oil-hardening steels can be hardened with less distortion and greater safety than water-hardening steels. Mineral oils are generally used because of their low cost and relatively stable nature.

(3) AIR. If sufficient alloying elements are present, critical cooling rates are decreased to the extent that certain steels can be quenched in either still or forced air.

While the choice of quenching medium is of prime importance, there is another factor that should not be overlooked. This is the agitation of the quenching bath. The more rapidly the bath is agitated, the more rapidly heat is removed from the steel, and the more effective the quench.

Bethlehem metallurgists will gladly help you with any problem related to quenching or other phases of heat-treatment. They are men of long practical experience in this field, and they understand fully the advantages and limitations of each method. Always feel free to call for their services; their time is yours, without obligation.

Remember Bethlehem, too, when you are next in the market for AISI standard alloy steels, special-analysis steels, or carbon grades. We are always in a position to meet your needs promptly.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.
On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. Export Distributor: Bethlehem Steel Export Corporation

BETHLEHEM *ALLOY* STEELS





from interchangeable parts...

Danly Die Set Service is Faster!



Choose the Danly Branch closest to you—

BUFFALO 7	1807 Elmwood Avenue
CHICAGO 50	2100 S. Laramie Avenue
CLEVELAND 14	1550 East 33rd Street
DAYTON 7	3196 Delphos Avenue
DETROIT 16	1549 Temple Avenue
GRAND RAPIDS	113 Michigan Street, N.W.
INDIANAPOLIS 4	5 West 10th Street
LONG ISLAND CITY 1	47-28 37th Street
LOS ANGELES 54	Ducommun Metals & Supply Co., 4890 South Alameda
MILWAUKEE 2	111 E. Wisconsin Avenue
PHILADELPHIA 40	511 W. Courtland Street
ROCHESTER 6	33 Rutter Street
ST. LOUIS 8	3740 Washington Blvd.
SYRACUSE 4	2005 West Genesee Street


One of the main reasons for Danly's faster die set service is the *interchangeability* of die set parts achieved by Danly. It starts at the main Danly Plant where die set components are produced to Danly's traditional high quality, precision standards. The faster service cycle continues at all of the Danly Branch Plants where thousands of *interchangeable* die set components are stocked. The cycle is completed at the Danly Branch in your area where these parts are assembled as a die set to meet your specific requirements and shipped as soon as your order is received. So remember—for the best in die sets in the shortest time, the place to call is your local Danly Branch.



DANLY MACHINE SPECIALTIES, INC.

2100 South Laramie Avenue
Chicago 50, Illinois

...to finished die sets

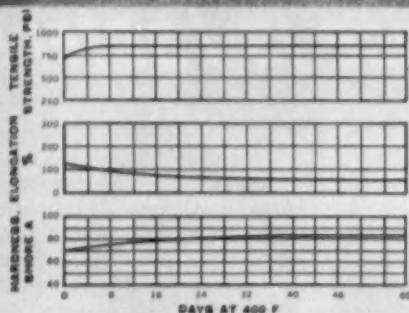


CLASS 300 (LOW COMPRESSION SET)



Absolute minimum compression set at ordinary and elevated temperatures. Ideal for O-rings, seals, gaskets. More "come-back" than any known rubber!

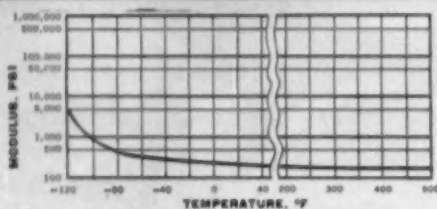
CLASS 400 (GENERAL PURPOSE)



Typical effects of even aging on physical properties of a Class 400 general purpose stock.

Most economical class, providing typical silicone rubber properties for gaskets, seals, O-rings, sleeves, boots, bellows, tubing, belting, shock mounts.

CLASS 500 (EXTREME LOW TEMPERATURE)



Effect of temperature on flexibility of a typical Class 500 Extreme Low Temperature stock. (Young's Modulus in Flexure)

Flexibility and recovery from compression down to -120°F! Ideal for high-altitude flight applications where low-temperature flexibility is vital.

G-E silicones fit in your future

GENERAL  ELECTRIC

Which class of G-E SILICONE RUBBER IS BEST FOR YOU?

General Electric silicone rubber is classified according to dominant property to make it easy for you to select and specify the *right* silicone rubber for the parts you need. You can be sure of *more exact performance* when you choose among the many classes of G-E silicone rubber.



Send today for free "Lightning Selector"! This handy chart makes it quick and easy for you to select and specify the best G-E silicone rubber for your job.

General Electric Company
Section 161-1B
Waterford, New York

Please send me product data on G-E silicone rubber, including a free "Lightning Selector" and up-to-date list of fabricators. I am chiefly interested in:

- | | |
|--------------------------------------|--------------------------------------|
| 1 () Molded gaskets, bushings | 9 () Extruded seals, tubing |
| 2 () O-rings | 10 () Reinforced ducting, hose |
| 3 () Molded boots, sleeves, bellows | 11 () Sheets and blankets |
| 4 () Shock mounts | 12 () Rubber bonded to metal |
| 5 () Rubber-covered rolls | 13 () Die-cut gaskets |
| 6 () Belting | 20 () Wire and cable insulation |
| 8 () Sponged products | 30 () Coated tapes, cloths, sleeves |

Name _____ Position _____

Firm _____

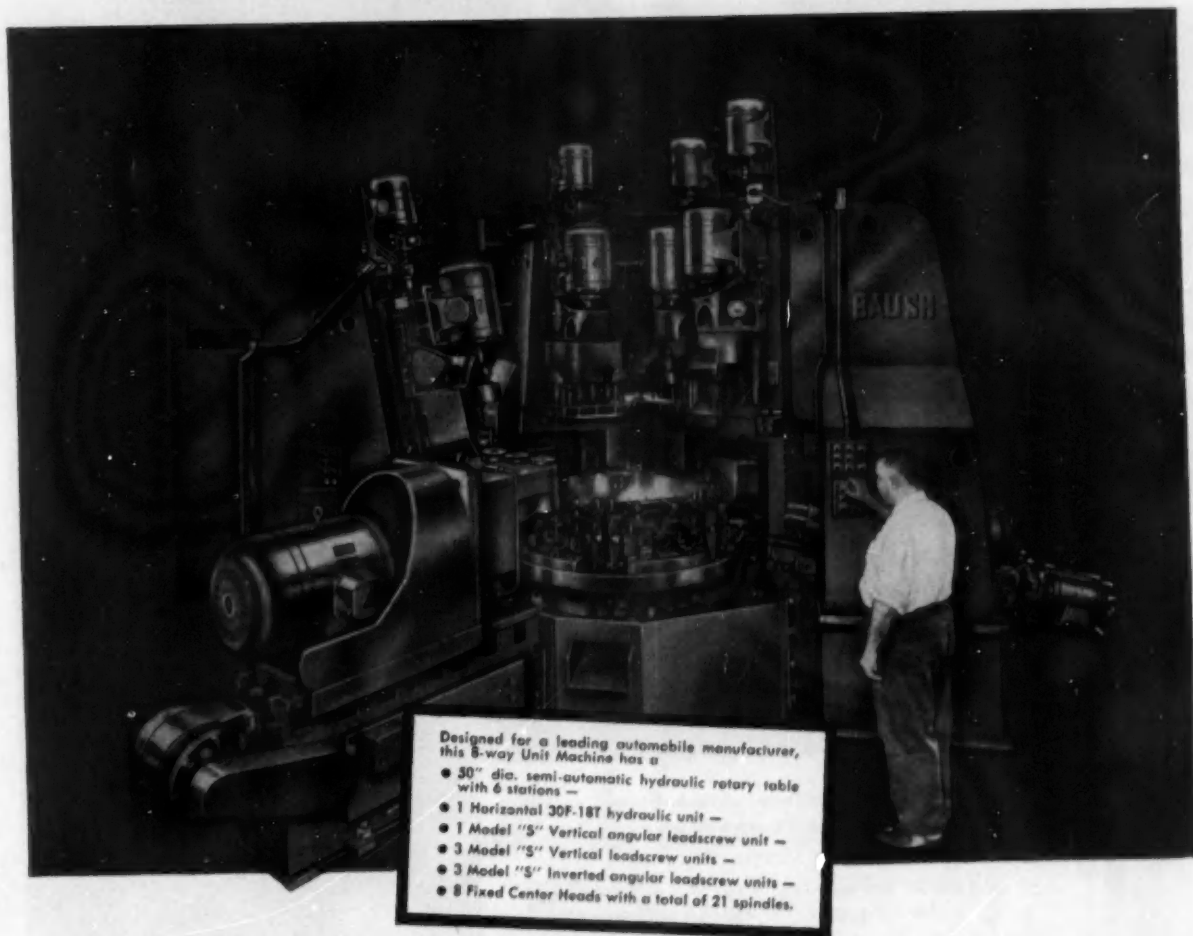
Street _____

City _____ Zone _____ State _____

IN CANADA: Mail to Canadian General Electric Company, Ltd., Toronto

100 EXHAUST MANIFOLDS EVERY HOUR

with this 8-Way Unit Machine with Rotary Table



Designed for a leading automobile manufacturer, this 8-way Unit Machine has a

- 30" dia. semi-automatic hydraulic rotary table with 6 stations —
- 1 Horizontal 30F-187 hydraulic unit —
- 1 Model "S" Vertical angular leadscrew unit —
- 3 Model "S" Vertical leadscrew units —
- 3 Model "S" Inverted angular leadscrew units —
- 8 Fixed Center Heads with a total of 21 spindles.

It is this kind of trouble-free, accurate production that has been the background of BAUSH machine tools. You can't do better than rely on Baush — why not let our engineers work with you on your machining problems?



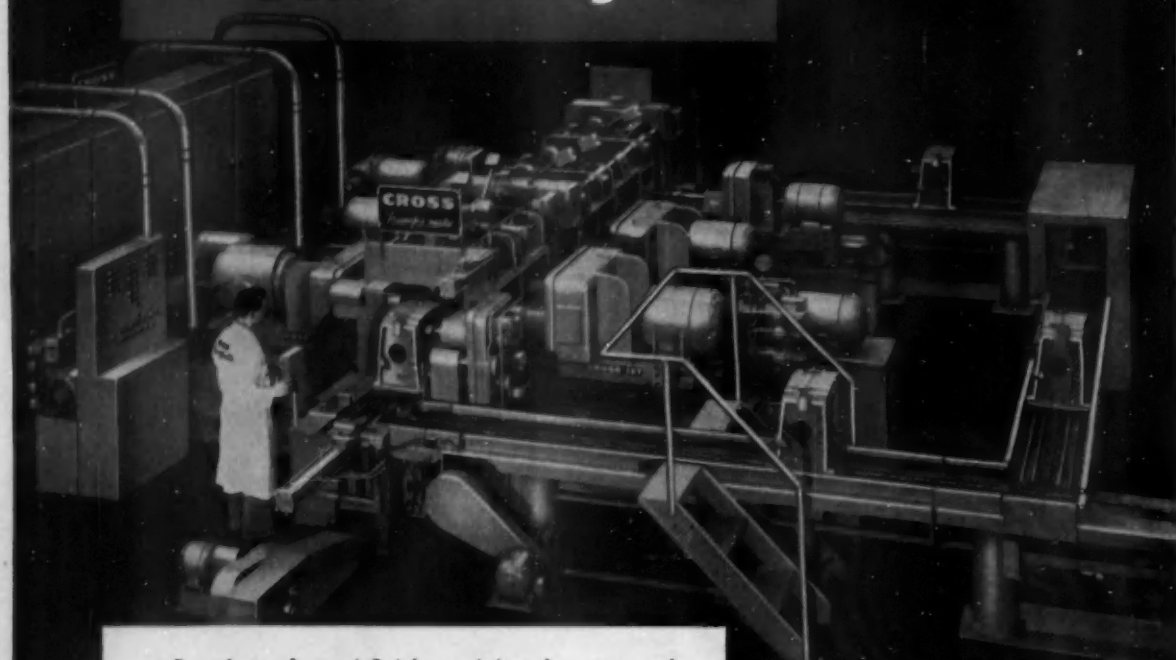
OPERATIONS: Mill mounting pads and exhaust pad — drill, coredrill, chamfer, ream and tap.

PRODUCTION: 100 exhaust manifolds per hour at 100% efficiency.

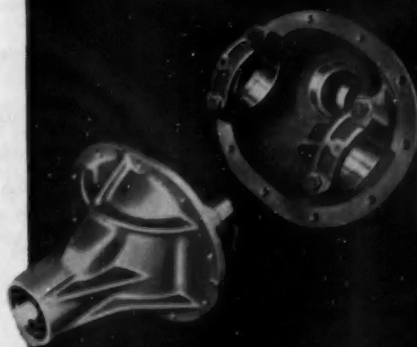
FIXTURE: Part sets into holding units in temporary location, and is hydraulically equalized, located and clamped from contours of bolt flange bosses. Hydraulically locked spring plungers give required support to offset tool thrusts. Hydraulic functions are controlled by hand valve at each station. Relief valves in operational cylinder supply line control sequence. All drilling and reaming stations have bushing plates that rest and register on holding units and slide on bars extending from heads. Hydraulic fluid power supplied from centrally located high pressure swivel. Chips shed towards outside of setup.

Another Transfer-matic by Cross

Machines Rear Axle Differential Gear Housings



- ★ Rough and semi-finishes pinion bores; rough bores, semi-finish bores and taps cross bores.
- ★ 155 parts per hour at 100% efficiency.
- ★ 9 stations—1 for loading, 4 for boring, 1 for tapping, 2 for indexing, 1 for visual inspection.
- ★ Pallet-type work holding fixtures.
- ★ Hydraulic power wrench for clamping parts.
- ★ Automatic transfer of fixtures from station to station.
- ★ Other features: Complete interchangeability of all standard and special parts for easy maintenance; construction to J.I.C. standards; hardened and ground ways; tandem drive for locating pins; hydraulic feed and rapid traverse; automatic lubrication; oil-mist lubrication for taps; drag-chain type chip conveyor.

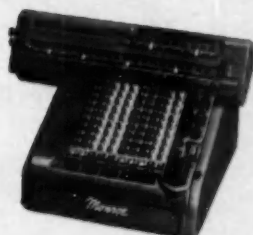


Established 1898

THE **CROSS** CO.
DETROIT 7, MICHIGAN
Special MACHINE TOOLS

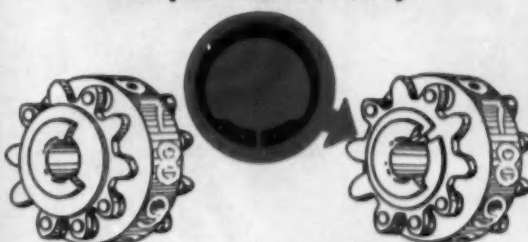
Waldes Truarc rings replace old-fashioned fasteners...save assembly time...end scrap loss...increase operating efficiency

This is the Monroe Calculator



...precision-engineered business machine made even more efficient, and less costly to manufacture through the use of Waldes Truarc Retaining Rings.

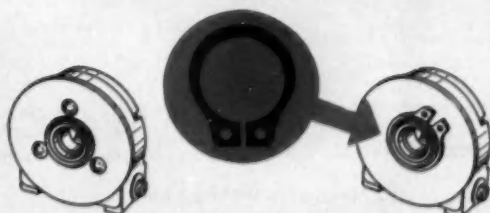
Multiplier Dial Assembly



Old Way. One-piece assembly was spun together. Spinning operation was costly, resulted in high scrap loss.

Truarc Way. Two-piece assembly is held together by one Truarc Ring (series 5100). Rejects: practically zero.

Electric Motor Governor



Old Way. Collector Disc assembly was formerly riveted, requiring skilled labor. Riveted Collector Disc could not be removed in the field.

Truarc Way. Truarc Ring (series 5100) replaces rivets, saves labor, material...improves Collector action. Collector Disc is easily replaced.

Intermediate Gear Shaft



Old Way. Washer riveted on end of assembly for zoning control. Costly, troublesome, hard to obtain critical zoning required.

Truarc Way. Truarc E-Ring (series 5133) cuts assembly time, virtually eliminates rejects and final assembly and zoning problems.

Monroe Calculating Machine Company, Orange, N. J. uses various types and sizes of Waldes Truarc Retaining Rings. Use of Truarc has helped eliminate scrap losses, saved on material and labor, and resulted in increased operating and servicing efficiency of the product. Monroe plans to use Truarc Rings for every possible fastening operation on their entire line!

You, too, can save money with Truarc Rings. Wherever you use machined shoulders, bolts, snap rings, cotter pins, there's a Waldes Truarc Retaining Ring designed to do a better, more economical job. Waldes Truarc Rings are precision-engineered...quick and easy to assemble and disassemble.

Find out what Waldes Truarc Retaining Rings can do for you. Send your blueprints to Waldes Truarc Engineers for individual attention, without obligation.



SEND FOR NEW CATALOG

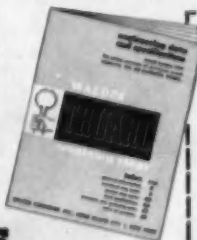
WALDES TRUARC

RETAINING RINGS

WALDES KOHINOOR, INC., LONG ISLAND CITY 1, NEW YORK

WALDES TRUARC RETAINING RINGS AND PLIERS ARE PROTECTED BY ONE OR MORE OF THE FOLLOWING U. S. PATENTS: 2,392,947; 2,392,948; 2,410,058; 2,420,921; 2,420,941; 2,420,795; 2,441,244; 2,455,165; 2,463,940; 2,463,943; 2,467,902; 2,467,903; 2,481,306; 2,509,051 AND OTHER PATENTS PENDING

For precision internal grooving and undercutting...Waldes Truarc Grooving Tool!



Waldes Kohinoor, Inc., 47-16 Astor Pl., L. I. C. 1, N. Y.
Please send me the new Waldes Truarc Retaining Ring catalog.

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Name

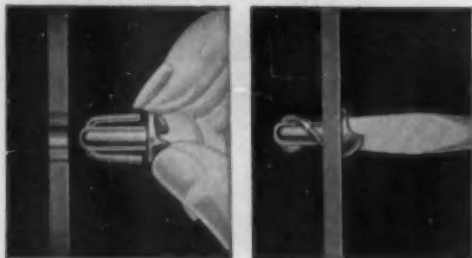
Title

Company

Business Address

City..... Zone..... State.....

Have you a similar use for this 1-piece fastener?

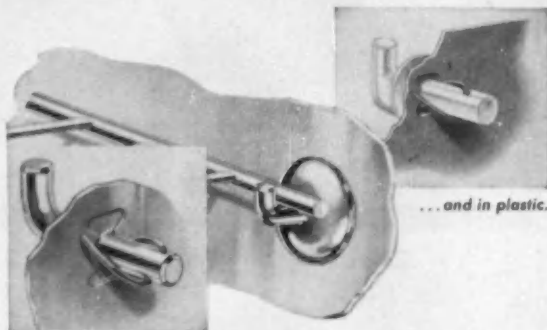


It's a Blind Rivet

...Or a removable fastener. It locks and unlocks with a 90° clockwise rotation. No mating parts such as nuts or receptacles are required.

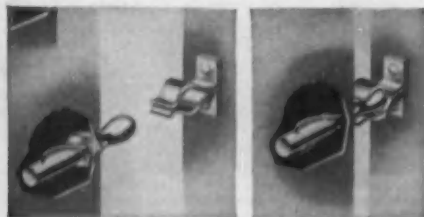
It's a Shelf Support

...For ranges or refrigerators—in plastic and metal. Leading appliance makers have achieved substantial installation savings through its use.



Both in metal...

...and in plastic.

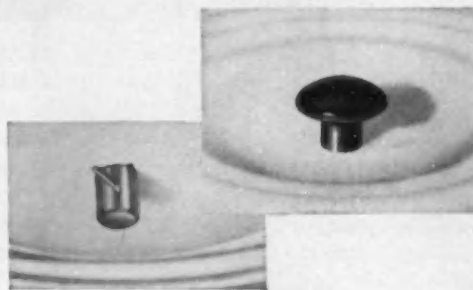


It's a Cabinet Door Strike

...Simple to install; eliminates welding and cuts assembly cost. Any head can be designed without affecting fastening principle.

It's a Lifter Knob or Dashboard Plug

...Plastic Spring-Lock heads are molded around steel inserts, giving strength at point of load or impact. Any shape head can be molded in any color.



What's Your Application?

...Tell us how you can use Spring-Lock Fasteners in your products. We'll be glad to work out the details with you.

Simmons

QUICK-LOCK
SPRING-LOCK
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NEW 36-PAGE CATALOG WITH APPLICATIONS
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SIMMONS FASTENER CORPORATION
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WHO wants a seat Just like the seat
that HARRIED dear old Dad?*



*you can't have style –
and roominess, too – with*

SOFAS-ON-WHEELS!

As long as motorists demand still lower, still sportier-looking cars, your seating problems will continue to mount.

Something must give, under those lower and lower tops of yours – and nothing can be more easily spared than over-bulky upholstery reminiscent of Grandma's parlor but out of place in a modern car.

Airfoam Development Engineers are making giant strides in that direction. Working with leading automotive designers, they are shaping entirely NEW seating.

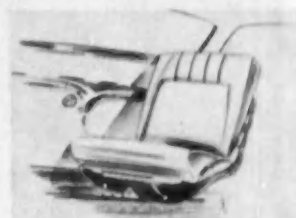
It's seating that will deliver superlative riding comfort – and without one cubic inch of useless bulk!

AIRFOAM seat-units can now be molded as a one-piece finished cushion. This will eliminate springs, loose padding and much costly upholstery work. Best of all it adds style and glamour to your smartest models – and will reclaim more usable ROOM, while giving driver and passengers a more comfortable ride.

Like to check on the progress already made? Simply contact Goodyear, Automotive Products Dept., Akron 16, Ohio.



AIRFOAM makes interiors roomier, more luxurious



Exciting new seating ideas become practical with AIRFOAM



AIRFOAM gives custom looks at competitive prices



AIRFOAM can be your greatest sales-aid in years

Airfoam
MADE ONLY BY **GOOD YEAR**
THE WORLD'S FINEST, MOST MODERN, CUSHIONING

Airfoam – T. M. The Goodyear Tire & Rubber Company, Akron, Ohio

*Used by permission of Harry Von Tilzer Music Pub. Co.



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IN THE REALM OF FORGING
DESIGN AND THE DEVELOPMENT
OF PROPER GRAIN-FLOW, WYMAN-
GORDON HAS ORIGINATED MANY
FORGING DESIGNS WHICH AT THE
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WERE CONSIDERED IMPOSSIBLE
TO PRODUCE BY FORGING.

WYMAN-GORDON

Established 1883

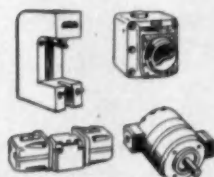
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pressure control
up to 5000 psi**



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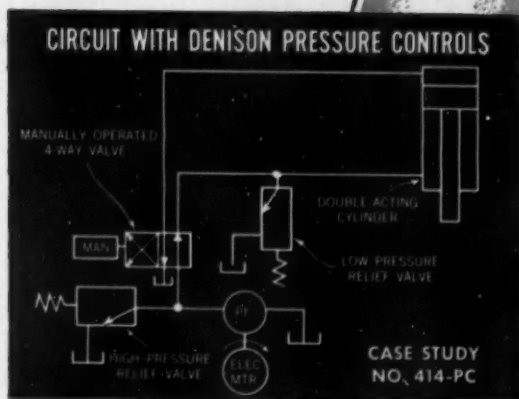
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...for relief, sequence,
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Denison Pilot Operated Valves provide precision control for your hydraulic circuits for any pressure need up to 5000 psi. With Denison Valves, pressure control is uniformly accurate because of a low differential between valve opening and closing pressure.

Valve action is chatter-free for efficient operation on high or low pressure applications.

A complete line includes relief, sequence, unloading and pressure-reducing valves . . . all hydrostatically balanced . . . $\frac{3}{4}$ to $1\frac{1}{2}$ -inch port sizes. Write for Bulletin VR-2C.

**THE
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DENISON
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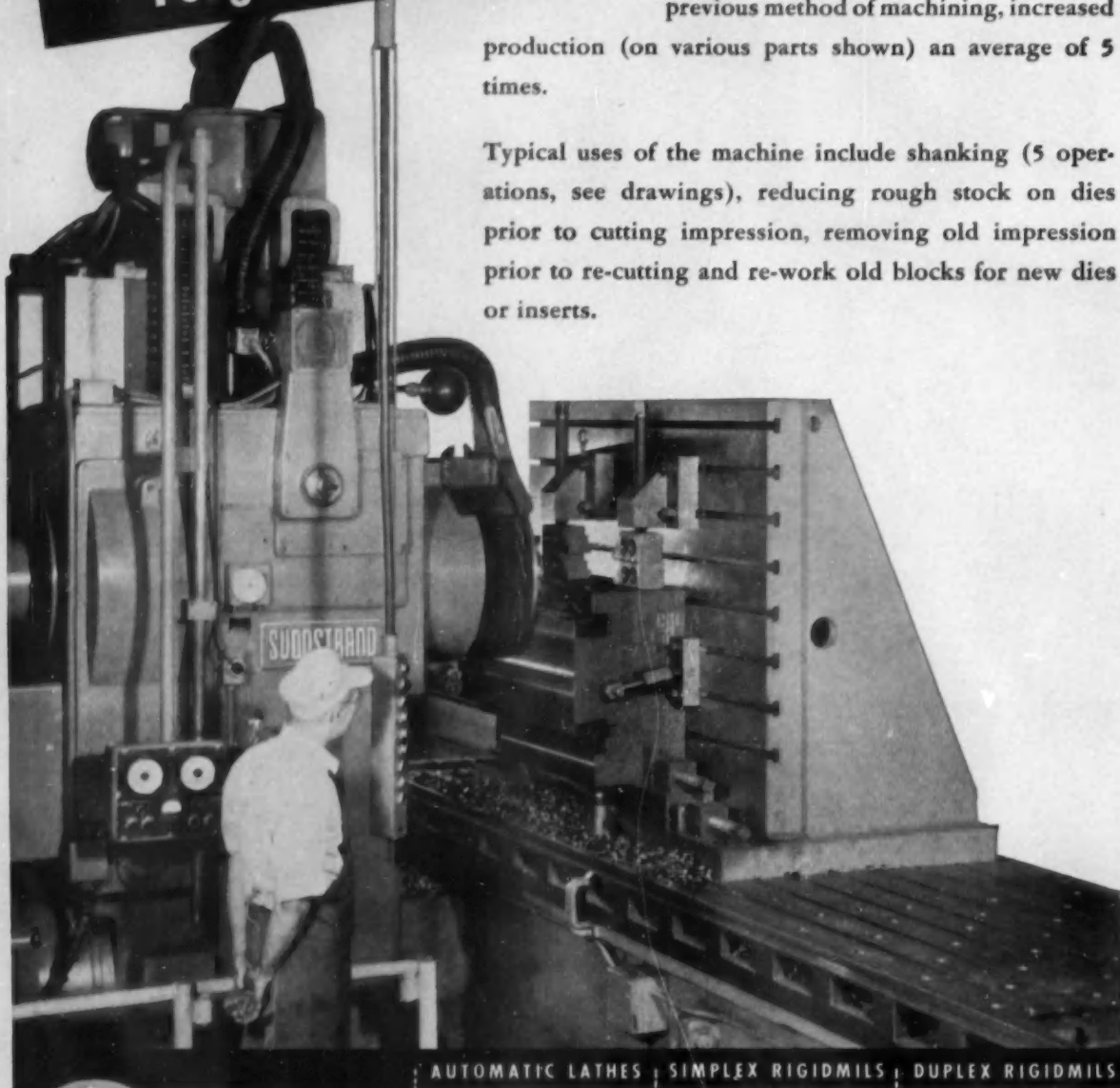
Here's THE Machine For Miscellaneous Die Block Milling In Forge Shops

Milling Increases Production 5 Times

Here's a machine designed for heavy work such as milling die blocks from rough, removing impression before re-cutting on used die blocks, and similar heavy jobs. Milling, as compared to the previous method of machining, increased

production (on various parts shown) an average of 5 times.

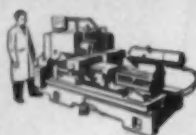
Typical uses of the machine include shanking (5 operations, see drawings), reducing rough stock on dies prior to cutting impression, removing old impression prior to re-cutting and re-work old blocks for new dies or inserts.



"Engineered
Production"
Service®

REG. U.S. PAT. OFF.

AUTOMATIC LATHES | SIMPLEX RIGIDMILS | DUPLEX RIGIDMILS





Typical parts machined on the Sundstrand Model 77 Rigidmil.

The Sundstrand Model 77 Rigidmil is a heavy-duty machine capable of taking heavy cuts with carbide cutters. It has vertical feed to head in combination with longitudinal table feed so that an automatic square cycle can be obtained for rough milling of die shanks. Machine can be operated automatically or manually. The spindle head is of the horizontal type and is available up to 100 horsepower. Although the machine illustrated is a Model 77 Rigidmil, both larger and smaller Sundstrand machines are available for similar heavy duty milling. If you have work of this nature, investigate Sundstrand "Engineered Production" Service. There is no obligation.

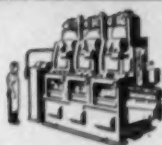
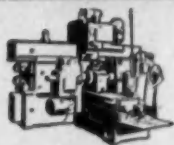
Additional Data

Additional information is available in this folder. Write for your copy today. Ask for bulletin 252.



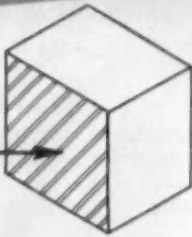
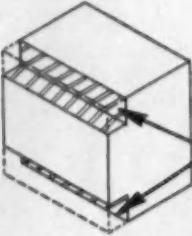
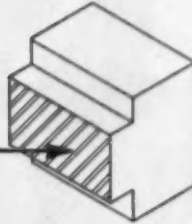
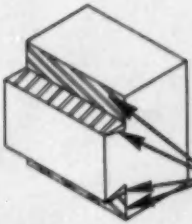
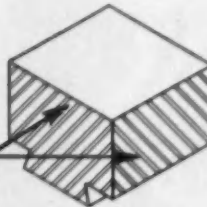
TRIPLEX RIGIDMILS

SPECIAL MACHINES



TYPICAL OPERATIONS

Below are shown the sequence of operations for shanking of die blocks. The die blocks shown are 16" x 16" x 12" and the time for milling a matching set was less than 4½ hours. Larger sizes can be machined with a proportionate saving in time over conventional methods.

- 1 **Mill Impression Face** 
- 2 **Ruff Out Shank** 
- 3 **Finish Top of Shank** 
- 4 **Finish Mill Shank Including 5° Dovetail** 
- 5 **Finish Mill Matching Edges** 

SUNDSTRAND
Machine Tool Co.

2571 Eleventh St. • Rockford, Ill., U.S.A.

VERSATILE



MECHANICS Roller Bearing UNIVERSAL JOINTS excel for both main drives and controls — in all kinds of material handling trucks. Have transmission flanges for any type of brake drum. Easy to service — MECHANICS Close-Coupled UNIVERSAL JOINTS transmit more power — in less space — at greater angles than any other joints. Let MECHANICS engineers help give your machines competitive advantages.

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Here's why it pays to know your



DICK BULL, HSM (Honeywell Supplies Man) in the Los Angeles area, tells Clyde Rosellen, research engineer at North American Aviation, Inc., about the many quality features of Brown thermocouple extension wire to be used in certifications for the company's heat-treating furnaces.

Expert, personalized service is the keynote of the HSM Plan. This modern way to specify and buy pyrometer supplies can bring important improvements in economy and convenience for your own purchases, too. Your nearby HSM will be glad to show you how the Plan can work for you. Call him today . . . he's at your local Honeywell office, as near to you as your phone.

MINNEAPOLIS-HONEYWELL REGULATOR CO., Industrial Division.

West Coast Offices: 2840 E. Olympic Blvd., Los Angeles, Calif.; 104 S.E. 7th Ave., Portland, Ore.; 1136 Howard St., San Francisco, Calif.; 430 8th Ave., North, Seattle, Wash.; 917 W. Mallon St., Spokane, Wash.

● REFERENCE DATA: Write for booklet, "The HSM Plan" . . . and for Pyrometer Supplies Buyers' Guide No. 100-5.

MINNEAPOLIS
Honeywell
BROWN INSTRUMENTS

First in Controls



R/M

FIRST IN FRICTION

HOW R/M ENGINEERING SETS



The sintered metal clutch facings, discs, brake linings and other friction parts pictured here suggest the wide variety of sizes and types that Raybestos-Manhattan, for over 50 years the world's largest maker of friction materials, is manufacturing for specialized applications. The exclusive, patented "metallo-ceramic" bond used by R/M in sintered metal friction materials produces a compound distinctly superior to the common straight alloy bond of copper and tin.

**THE RECORD OF "FIRSTS" IN
FRICTION MATERIAL DEVELOPMENT
SHOWS WHY R/M IS
FIRST IN FRICTION**

FIRST Woven Brake Lining • FIRST Asbestos Brake Lining • FIRST Ground Wearing Surface • FIRST Zinc Alloy Wire Brake Lining • FIRST Pre-Treated Yarns • FIRST Extruded Pulp Brake Lining • FIRST Flexible Pulp Brake Lining in Rolls • FIRST Dry Process Brake Lining • FIRST Semi-Metallic Brake Lining • FIRST Bonded-to-Metal Brake Lining • FIRST Woven Clutch Facings • FIRST Molded Asbestos Clutch Facings for Clutches Operating in Oil • FIRST Endless Woven Clutch Facings • FIRST Pre-Treated Clutch Facings • FIRST Bonded-to-Metal Clutch Facings

THE PACE IN FRICTION MATERIAL DEVELOPMENT

SINTERED METALS

Do you have a friction material application where high temperatures and close tolerances are factors? Or where friction components must be held to a minimum thickness? If so, Raybestos-Manhattan Sintered Metal friction parts may be an exact answer to your problem.

R/M full sintered friction materials are best described as matrices of sintered metal mechanically entrapping both metallic and non-metallic friction-augmenting agents.

Speaking generally, they are most useful where K.E. absorption per square inch of friction material is very high. Or where engagements occur on a repetitive cycle with little time interval. Under such severe conditions, organic-content materials wear at an accelerated rate. R/M Sintered Metals will perform without appreciable increase in wear rate because of their high thermal conductivity and the absence of a destructible bond.

The work done and heat generated by friction material are a function of the pressure involved. A reasonable working range for asbestos materials in dry operation is 25-100 psi. With sintered metal friction material you may go as high as 400 psi.

R/M Sets the Pace in Both the Metal and Asbestos Fields

Raybestos-Manhattan Sintered Metal compounds are designed to meet a distinct and special group of application requirements. They are intended to *supplement* asbestos molded and woven lines—not replace them.

That is why R/M—the leader in both the asbestos and metal fields—is in a unique position to help original equipment manufacturers. Unlike other makers in its field, R/M works with all kinds of friction materials—from woven and molded asbestos to cork-cellulose, semi-metallic, and sintered metals. When you consult an R/M engineer, you can be sure of a *completely unbiased recommendation* as to which friction materials are best suited for your particular application.

If you are looking for friction materials with greater output and durability, call in your R/M representative. The full depth and breadth of R/M experience—the complete facilities of R/M's seven great plants with their research and testing laboratories—are at your disposal to either develop a special material for your requirements or suggest how you can redesign to make effective use of an R/M material already on hand.

Write for your free copy of R/M Bulletin No. 500. Its 44 pages are loaded with practical design and engineering data on all R/M friction materials.



FIRST IN FRICTION

THE TRADE-MARK
THAT SPELS
PROGRESS IN
FRICTION MATERIAL
DEVELOPMENT

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FACTORIES: Bridgeport, Conn. • Manheim, Pa. • Passaic, N.J. • No. Charleston, S.C. • Crawfordsville, Ind. • Neenah, Wis.

Canadian Raybestos Co. Ltd., Peterborough, Ontario, Canada

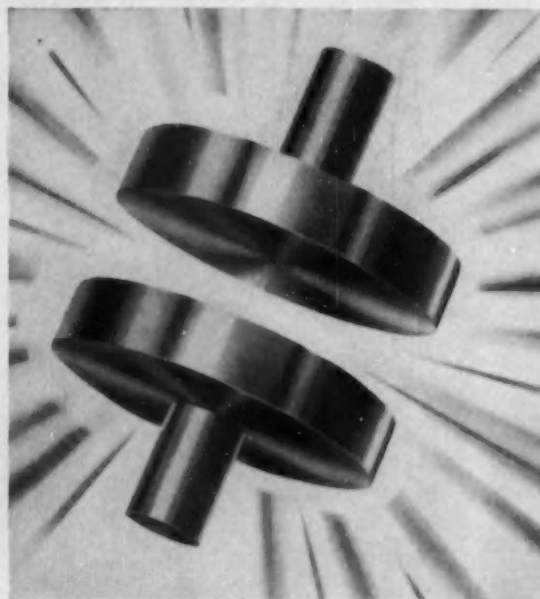
RAYBESTOS-MANHATTAN, INC., Brake Linings • Brake Blocks • Clutch Facings • Fan Belts • Radiator Hose • Industrial Rubber, Engineered Plastic, & Sintered Metal Products • Rubber Covered Equipment • Asbestos Textiles • Packings • Abrasive & Diamond Wheels • Bowling Balls

Are the contacts you use
GOOD ENOUGH...
or TOO GOOD ?

The answer to this question can make an important difference in the performance and cost of your product. If your contacts do not measure up to their intended job, they can seriously detract from the satisfactory operation, freedom from maintenance, and acceptance of the equipment in which they are used. If the contacts are too good, or over-designed, they add uselessly to the cost of the finished equipment.

Designing a contact for a specific job, however, is a real engineering problem. It involves consideration of many electrical, mechanical and environmental factors. The current and voltage in the interrupted circuit... the type of load... the expected service life... contact gap... contact pressure... ambient temperature and atmosphere... these and many other aspects of the problem demand evaluation.

From Mallory, you can be sure of getting contacts that will perform correctly in your application... at a price that fits your production budget.



THE RIGHT MATERIALS. The extensive selection of contact materials developed by Mallory's metallurgical research includes an unequalled variety of specialized materials.

THE RIGHT DESIGN. Mallory engineers apply to your problem the knowledge gained in thirty years of contact experience. Standard designs are recommended wherever possible for standard requirements... and for special needs, custom-fitted designs are developed.

THE RIGHT PRICE. Mallory cost-saving design assures top economy consistent with service requirements. Further economies are often realized by having Mallory fabricate your complete contact assemblies for you.

A Mallory engineer will be glad to discuss your particular problem. Write or call today for a consultation, and for a copy of the Mallory Contact Catalog.

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TU-FLO COMPRESSOR

400

*The Finest Ever Built
for the Trucking Industry!*

That's a fact! Results of tests run by actual fleet operators over thousands of miles of actual day-after-day, 'round-the-clock truck operation prove this rugged new compressor superior in all performance departments! Here's what the participating operators reported about TU-FLO 400 performance . . . "Produces more air at low and medium speeds where we need it most . . . has the best oil control of any compressor we've ever had . . . discharge temperatures are

lower over the entire speed range . . . needs no periodic adjustment because it has no external moving parts . . . operates more efficiently at the higher speeds developed by our new engines . . ."

But prove it for yourself—install a TU-FLO 400—available on an exchange plan through your Authorized Bendix-Westinghouse Distributor. We're sure you'll agree with all the others that here, indeed, is the finest compressor ever built for the trucking industry.



- New-design inlet valves
- New unloading mechanism
- No external moving parts
- Available with attached governor if desired
- Available either self- or engine-lubricated
- Available air or water cooled

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Another new development using

B. F. Goodrich Chemical *raw materials*



PLYPAK® waste retainer manufactured for Waugh Equipment Co., New York by Davidson Rubber Co., Boston, Mass. B. F. Goodrich Chemical Company supplies only the Hycar rubber used in manufacture.

HEAT'S OFF HOT BOXES!

ASK any railroader about "hot boxes"—overheated freight car journals—and he'll tell you they cause delayed schedules, repairs, even derailments. Losses run into the millions yearly. No easy problem to solve—but a manufacturer did it with a waste retainer molded from a compound employing Hycar American rubber.

Oil-saturated waste lubricates the journal but tends to work up around it. A jolt to the car often displaces the bearings momentarily, trapping waste beneath them. Result—lubrication is cut off and a hot box develops.

In this new retainer, comb-like projections molded into it *prevent* waste from climbing the journal and catching under the bearing.

Also, lubrication is actually improved. Vertical motion of the car alternately squeezes and releases the resilient retainer, giving a pumping action to help circulate the oil.

Parts made of Hycar rubber improve operations and cut costs in the transportation and other industries. Perhaps Hycar's exceptional resistance to abrasion, heat, cold, oil and gas can help you solve a tough product improvement or development

problem. For technical information, please write Department CA-1, B. F. Goodrich Chemical Company, Rose Building, Cleveland 15, Ohio. Cable address: Goodchemco. In Canada: Kitchener, Ontario.

B. F. Goodrich Chemical Company
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*T. M. Reg. U. S. Pat. Off.

Hycar
Reg. U. S. Pat. Off.
American Rubber

GEON polyvinyl materials • HYCAR American rubber and latex • GOOD-RITE chemicals and plasticizers • HARMON colors

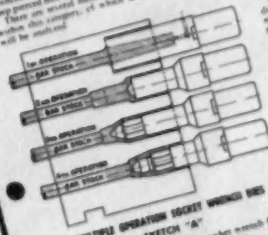

PRACTICE

ARTICLE 2

MULTIPLE OPERATION FORGINGS HAVING DEEP HOLES THAT DO NOT EXTEND THROUGH THE ENTIRE FORGING

**MULTIPLE OPENINGS
DO NOT EXTEND**

Examples of this type of burping are drug tanks, water
tranches, high exposure auxiliary shafts, etc., where the
deep pierced hole does not extend through the entire body.
(There are several methods of turning process that fall
within this category), of which several typical examples
will be mentioned.

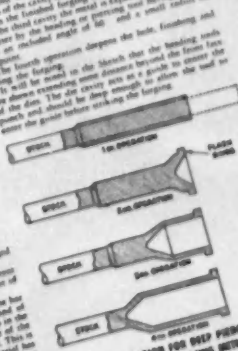


MULTIPLE OPERATION SOCKET WHICH DIES
SKETCH "A"

SKETCH "A"

The first one to be described is a washer which is forged out of a bar and having a deep cavity in the center. The number and shape of the different holes in the washer are as follows:

The first one is to determine the shape of the material to be cut. This is done by drawing a rough sketch of the material. To determine the numbers to form the edges the volume of the material is divided by the length of the material. This gives the number of pieces to be cut. The next step is to determine the shape of the material. This is done by drawing a rough sketch of the material. To determine the numbers to form the edges the volume of the material is divided by the length of the material. This gives the number of pieces to be cut. The next step is to determine the shape of the material. This is done by drawing a rough sketch of the material. To determine the numbers to form the edges the volume of the material is divided by the length of the material. This gives the number of pieces to be cut.

[illegible]

Sketch 'B' illustrates a multiple operation for deep pierced forming progressive piercing method. It shows a cross-section of a workpiece with a central hole and a surrounding ring. The workpiece is labeled 'STEEL' and '4140 ALLOY'. The central hole is labeled 'HOLE' and the surrounding ring is labeled 'RING'. The workpiece is shown in a state of being formed, with the central hole being deeper than the surrounding ring. The text 'MULTIPLE OPERATION FOR DEEP PIERCED FORMING' and 'PROGRESSIVE PIERCING METHOD' is visible. Below the sketch, the text 'SKETCH "B"' is present.

SKETCH "B"

A second method in this subject category is illustrated in "Sketch B" which shows the operations necessary to produce a logging having a deep hole such as a drag, but to where tender-type. In this sketch it should be pointed out that the material is gathered in a cavity in the dirt in the first operation rather than in the loading unit, thus producing the desired cross-section.

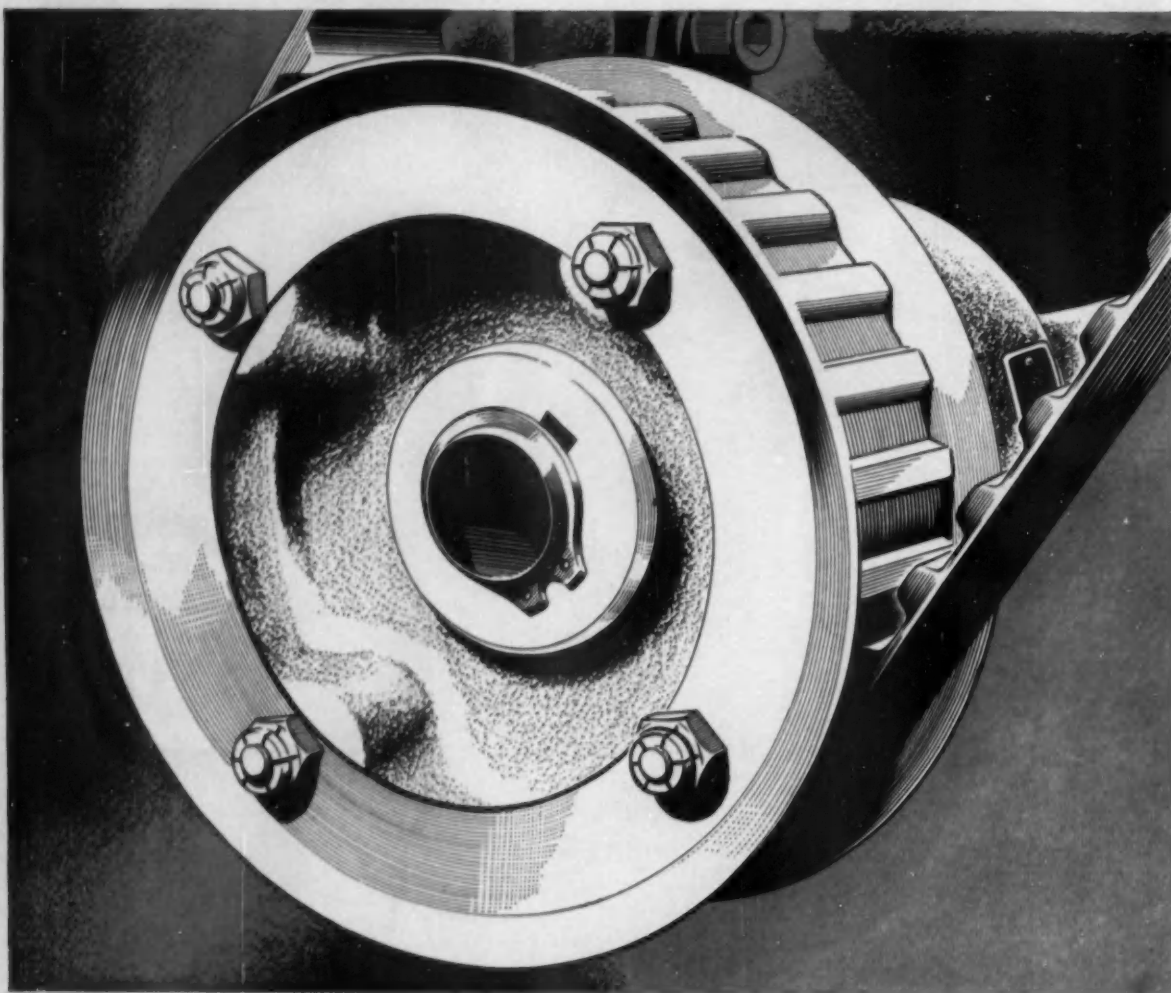
In the second operation the logging is discarded to the proper length and at the same time the fence and is

YOU ARE INVITED to have your name placed on our mailing list to receive this valuable series of articles on up-to-date forging methods. We will be glad to send a complete set of all eleven issues of "The Forger" in addition to placing your name on our mailing list to receive future issues as they are prepared. There is absolutely no charge for this service. We are glad to make this gesture towards the advancement of modern forging practice as executed on ACME XN Forging Machines.

THE HILL ACME COMPANY

ACME MACHINERY DIVISION • 1209 W. 65th St., Cleveland 2, Ohio
ESTABLISHED 1882

"ACME" FORGING • THREADING • TAPPING MACHINES • ALSO MANUFACTURERS OF "MILL" GRINDING AND POLISHING MACHINES
HYDRAULIC SURFACE GRINDERS • "CANTON" ALLIGATOR SHEARS • PORTABLE FLOOR CRANES • "CLEVELAND" KNIVES • SHEAR BLADES



MORE AND MORE FLEXLOC LOCKNUTS are being used to hold assemblies like this one together. This modern timing belt drive combines the flexibility of a steel cable belt with the positive action of a silent chain drive permitting its use at speeds up to 15,000 rpm.

FLEXLOC Self-Locking Nuts offer the same positive action as the drive. Once the locking threads are fully engaged, the nuts won't work loose, regardless of the vibration encountered. And FLEXLOCS are reusable.

FLEXLOCS are available in a wide range of sizes in any quantity. Stocks are carried by leading industrial distributors everywhere. Write for Bulletin 866 and samples for test purposes. STANDARD PRESSED STEEL CO., Jenkintown 53, Pa.

DO YOU KNOW? Standard FLEXLOCS clean rough threads on bolts, and make them even better. The locking threads on all-metal FLEXLOCS are not chewed up when used on rough bolts.

Standard FLEXLOCS lock securely on bolts varying in diameter tolerances. The all-metal, resilient locking sections of the nut accommodate themselves to the diameter tolerances. Standard FLEXLOCS are one piece, all metal. They are not affected by temperatures to 550°F. Nuts lacking these features have a more restricted temperature range.

Standard FLEXLOCS lock securely—stopped or seated—when 1½ threads of a standard bolt are past the top of the nut.

Standard FLEXLOCS are not affected by moisture, oil, dirt or grit. They lock efficiently under all conditions, regardless of the vibration encountered.

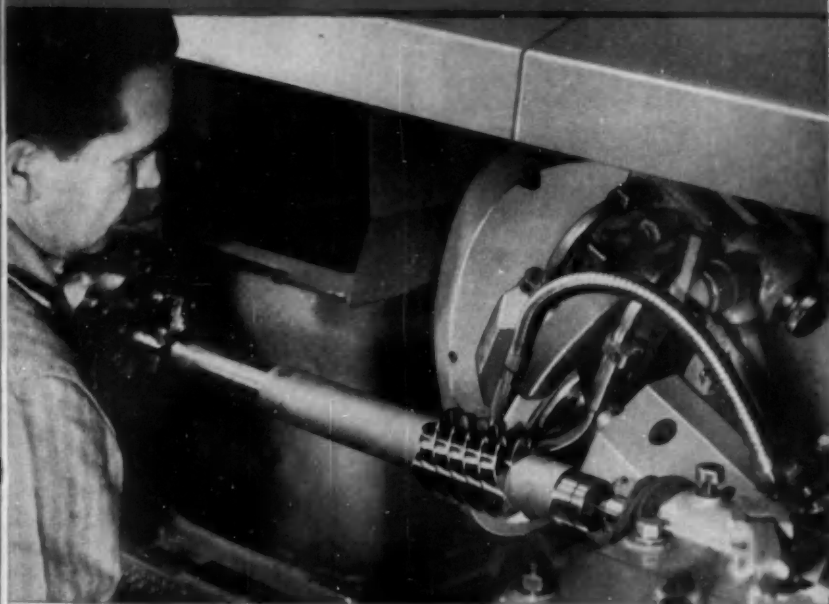


FLEXLOC®
LOCKNUT DIVISION

SPS
JENKINTOWN PENNSYLVANIA

Grinding 5-Start Worm with 4" Lead

STANDARD STYLE 36 EX-CELL-O *Precision* THREAD GRINDER

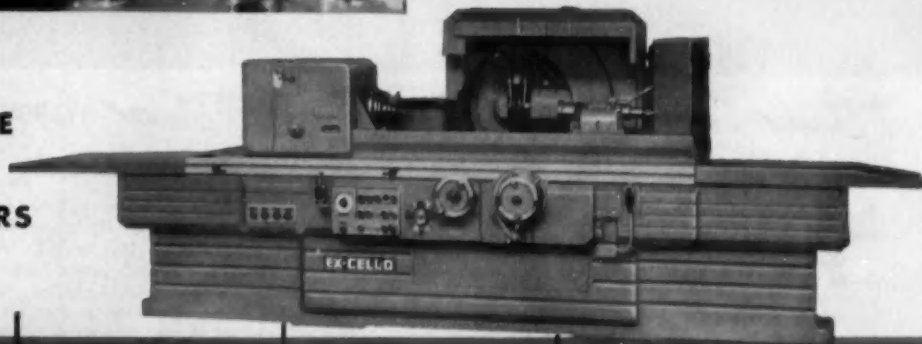


In the photograph at the left the operator is grinding a worm shaft for use in a special machine. The part is about 22" long and the worm is 4½" long, 3.430" O.D., has 5 starts, a pitch of .800", a lead of 4" and a tooth depth of .5454". The worm was ground in two operations on a standard Style 36 Thread Grinder. It was rough ground from the solid, hardened, then finish ground.

For complete information and specifications on the Style 36 and other Ex-Cell-O Thread Grinders contact your local representative or write today to Ex-Cell-O.



A COMPLETE LINE OF PRECISION THREAD GRINDERS



STYLE 30
Precision Thread Grinder—a versatile machine for external work, also available with internal attachment.

STYLE 33
Precision Thread Grinder—a high production machine for external work.

STYLE 39-A
Precision Thread Grinder—a high production machine for internal threads.

STYLE 36
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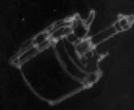
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John Pfeffer, Promotion Mgr.
Charles W. Hevner, Research Mgr.
Chestnut and 56th Sts.
Philadelphia 39, Pa.
Phone GRanite 4-5400

REGIONAL MANAGERS

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916 London Guarantee
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Phone FRanklin 2-4243

DETROIT—E. E. Elder
1015 Stephenson Bldg.
Detroit 2, Mich.
Phone TRinity 5-2090

PHILADELPHIA AND NEW YORK—
Nelson W. Sieber
Chestnut and 56th Sts.
Philadelphia 39, Pa.
Phone GRanite 4-5400
and
100 East 42nd St.
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High Spots of This Issue

★ New Highs Established in Horsepower and Torque

Outputs of engines installed in 1955 model cars indicate clearly that no quarter has been asked and none given in the contest for bigger and mightier power plants. Lower-priced cars are no exceptions, as the rating tables show. Page 48.

★ Heat Treating of Aircraft Engine Gears

In view of the omnipresent strength-weight ratio problem, heat treatment of aircraft engine gears requires painstaking care. The author outlines the procedures followed at Dana Corp. to obtain the necessary results. See Page 50.

★ Coaxial Power Steering Gear Production Equipment

Fine dimensional tolerances are an absolute requisite for such precision-made products as power steering mechanisms. Thus, the equipment found at Chrysler's Trenton, Mich., plant, as described here, is special in nature. Page 54.

★ Machining Pistons and Connecting Rods at Packard

Supplementing several previous stories on Packard's V-8 engine plant at Utica, Mich., this article covers highlights of piston and connecting rod production. Selective operations are described and illustrated. Page 62.

★ SAE Holds First Golden Anniversary Meeting

Last month's annual gathering in Detroit was the first of 11 SAE Golden Anniversary Meetings scheduled for 1955. A grand total of 59 papers and panel discussions were featured, and some of the former are abstracted here. Page 68.

★ 24 New Product Items And Other High Spots, Such As:

Studebaker's new models with higher horsepower; motor-driven engines on the assembly line; all-plastic construction economical for truck cab; continuous plating of bumpers in huge automatic machine; and making torsion bars for new passenger car suspension.

Automotive and Aviation News, Page 33
Complete Table of Contents, Page 3

AUTOMOTIVE INDUSTRIES COVERS—
PASSENGER CARS • TRUCKS • BUSES • AIRCRAFT • TRACTORS • ENGINES
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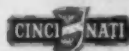
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News of the AUTOMOTIVE AND AVIATION INDUSTRIES

Vol. 112, No. 3

February 1, 1955

GM Offers to Repurchase Cars Unsold by Dealers

The announcement by General Motors Corp. that it is prepared to buy back any unsold new cars in stocks of franchised dealers is another step by the corporation to curb bootlegging. Last March, GM tried to get a repurchase clause written in contracts with its dealers, but the Justice Dept. turned the proposal down.

While the new plan is not meant to be part of an actual contract, its basic intentions are the same as those GM proposed last year. Under the former plan, GM asked that a specific clause be written into the factory selling contract which would have given the manufacturer prior right to buy back the unsold new car at the price paid by the dealer. Structure of the new alternative plan is the same, except that it is optional and non-contractual.

American Motors Predicts Profit in Next Few Months

American Motors Corp., which has reported losses since it became a corporate firm last May, expects to show a profit within the next few months. Important savings are expected to be realized in 1955 through further integration of Nash and Hudson operations.

AMC sales for the fiscal year ended Sept. 30, 1955, totaled \$400.34 million, but the net loss reported by the company on Dec. 9 for the 1954 fiscal year amounted to \$11.07 million, after a tax recovery of \$11.59 million.

The loss was attributed to costs for new car model changeovers and the movement of production facilities. AMC had a net working capital of \$82.08 million at the close of the fiscal year, excluding its \$43.80 million bank credit which it did not use.



STUDEBAKER SPEEDSTER IN LIMITED PRODUCTION

Scheduled for limited production on special order only, the Speedster is a sports car version of the 1955 Studebaker President hardtop convertible series. The car stands slightly over 56 in. high, measures 204½ in. in length, and is equipped with race car fittings augmented by power assists. Power plant is a 185-hp, V-8 engine.

Lincoln-Mercury Steps Up Output at St. Louis Plant

Since high automobile sales have been outstripping production rates, many car manufacturers have been extending working hours of production workers and adding new shifts. This has occurred not only in Detroit, but at other plants throughout the country.

Among the latest to take the step is the Lincoln-Mercury assembly plant in St. Louis, which is now operating a second shift. Output of the plant, which supplies Mercury cars to 750 dealers in 24 states, will nearly double to about 640 units a day when the new shift is in full operation shortly.

Sales Records Chalked Up By Several Car Companies

Automobile sales by some companies, along with production achievements, have reached new records. Cadillac reached a new sales record of 15,129 cars during December, 1954; Buick sold more than 50,000, best since December, 1950; and Oldsmobile delivered 40,918 cars for the sec-

ond highest month in its history.

The favorable reaction to Chrysler Corp.'s 1955 cars is reflected in a report which shows that sales of the new Chrysler and Imperial cars for the last ten days of December increased more than 30 per cent over the same period in 1953, with deliveries totaling 5040 cars. Sales for all of December totaled 13,230 to make it the best month for Chrysler Div. since July, 1953.

Ford Aims at 25 Per Cent Of Industry Sales in 1955

Ford, which sold more automobiles last year than it did in any year since 1925, is looking ahead to another good year. It hopes to capture at least 25 per cent of the total industry market. The aforementioned figure would be about the same sales penetration the company anticipates for 1954, when final industry registration figures are compiled. However, it would have to sell about 75,000 more cars in 1955, if industry sales total the 5.8 million units predicted for this year, to reach this percentage.

News of the AUTOMOTIVE



PACKARD SHOW CAR REVIVES CLASSIC FRONT-END

The Packard Request, created by reworking a 1955 Packard 400 sedan, was featured in the company's display at the recent Chicago Automobile Show. Bringing a new and modern styling revival to the classic front-end treatment that was a Packard trademark for many years, the special show car was built in answer to requests for an up-to-date version of the classic radiator design that Packard abandoned in 1951.

1955 Chevrolet to Pace Indianapolis Classic

A 1955 Chevrolet V-8 convertible will pace the 39th running of the 500-mile Indianapolis Race on May 30. The last time a Chevrolet was used to pace the cars on their starting lap was in 1948, when Mauri Rose, now a Chevrolet experimental engineer, won the race for the second consecutive year and set a speed record.

GM Expanding Its Aid To Higher Education

General Motors Corp. has announced a plan to spend \$2 million on new grants and scholarships to 306 colleges and universities in 38 states. Within four years, its total contributions to the support of higher education will amount to \$4.5 million annually.

The new funds are additions to the \$2.5 million contribution for operation of the General Motors Institute in Flint, Mich., and other grants which GM has customarily made in the past. Included have been 24 fellowships at 14 universities.

Under GM's new plan, four-year scholarships will be awarded 350 promising students this year; within four years, 1400 students will be bene-

fitting. In addition, private colleges and universities will receive grants-in-aid averaging \$500 to \$800 annually per student. At least one scholarship will be granted in each state to winning students who may select any accredited college or university.

Another phase of the grant is the foundation plan, under which GM will make unrestricted grants of \$10,000 each to foundations representing colleges in Michigan, Indiana, New York, Ohio, Pennsylvania, and New England. In addition, a grant of \$35,000 will be made to the United Negro College Fund for operating expenses of 31 Negro colleges.

Handling Equipment Maker Acquired by F. L. Jacobs

No plans are reportedly in the works at present by F. L. Jacobs Co., Detroit automobile parts maker, to move any of the manufacturing facilities of Colson Corp., Elyria, O., materials handling equipment maker, which Jacobs acquired recently. In addition to two Ohio plants and one in Somerville, Mass., Colson has warehouses in Chicago and Union City, N. J., and a subsidiary in Toronto, Canada. Colson is the third company that Jacobs has acquired recently.

First New Ford Car Plant Since 1947 To Open Soon

Ford Div.'s new 1.5 million sq ft automobile assembly plant in San Jose, Calif., will be in operation by March 1. First new plant built by Ford since 1947, it is one of three assembly units to be completed this year under a program started about two years ago to replace outmoded car assembly facilities.

Two other plants which will be ready this year include a 1.5 million sq ft facility at Louisville, Ky., and a 1.9 million sq ft plant at Mahwah, N. J. The San Jose plant, which replaces Ford's old assembly facility in Richmond, Calif., will have a capacity of 880 vehicles daily on two shifts.

Power Steering Pioneer Sets Up Harvard Fund

Francis W. Davis, pioneer in the development of power steering for automobiles, has established a Lionel S. Marks Fellowship Fund at Harvard University. Mr. Davis, a member of the Harvard Class of 1910, studied mechanical engineering with Professor Marks in his college days.

Mr. Davis' hydraulic power steering gear was patented in 1931, and this was followed by more than 20 additional U. S. and foreign patents.

Highway Transport Issues Studied at TTMA Meeting

Keyed to the general theme, "Highway Transport Issues and Action—1955," the 14th annual convention of the Truck-Trailer Manufacturers Association was held at Boca Raton, Fla., Jan. 27 to 29.

Maj. Gen. B. F. Hayford, Deputy Chief of Transportation, Dept. of the Army, addressed the group on "Army Transportation Corps Vehicle Requirements" during the opening luncheon. Other events on the program included: a seminar on truck-trailer equipment; a discussion on projected production and material controls in event of a national emergency; an analysis of the truck-trailer of the future; and a progress report on vehicle refrigeration research and development.

AND AVIATION INDUSTRIES

Packard 1955 Line Prices Range from \$2585 to \$4080

Advertised-delivered prices for 1955 Packard cars range from \$2,585 in the Clipper Series to \$4,080 for the 400 hardtop model. Due to a completely new line-up of cars for 1955, plus a new torsion bar suspension as standard equipment on two models, no valid comparison as such can be made with prices on last year's models.

The new system of full torsion bar suspension is offered by Packard for its Clipper Custom and Packard cars. Price of the Packard Caribbean, a custom sports convertible which Packard will offer this year, has not yet been announced. Prices of all Packard cars will differ throughout the country, as those of other car manufacturers, because of new adjustments made in freight rates by the industry on 1955 automobiles.

PACKARD LINE PRICES*

Packard	1955
Patrician four-door	\$4,040
Hardtop 400	4,080
Clipper	
Deluxe four-door sedan	2,585
Super four-door sedan	2,685
Super Panama hardtop	2,775
Custom four-door sedan	2,925
Custom Constellation	3,075

*Advertised-delivered prices, including Federal excise taxes, delivery, and handling charges.

General Tire Withdraws Offer To Motor Products

General Tire & Rubber Co.'s withdrawal of its offer to buy stock control of Motor Products Corp., Detroit automobile parts and appliance concern, has sparked new hope for solving some of the company's critical problems. The stock-buying war, started by Motor Products employees to prevent the Akron, O., company from taking control, was believed to be the most influential factor which caused General Tire to drop its \$7 million offer.

General had been seeking to acquire control of the Detroit firm since last August. Complications developed when Motor Products employees, hoping to influence other small stockholders to retain their holdings, launched a mass movement to purchase stock themselves under a monthly installment



CHRYSLER TO PUT 300-HP HARDTOP INTO PRODUCTION

The new Chrysler 300 hardtop, expected to go into production shortly, is powered by a modified Chrysler V-8 FirePower engine with an output of 300 hp at 5200 rpm. Bore is 3.81 in.; stroke, 3.63 in.; displacement, 331 cu in.; and compression ratio, 8.5 to 1. Modifications include two four-barrel carburetors, a full-race camshaft, and rocker arm valve adjustment. It is equipped with a dual exhaust system, power brakes, PowerFlite transmission, and manual steering, while rear axle ratios of 3:36 to 1 and 3:54 to 1 are available. Car has a 126-in. wheelbase, length of 219 in., width of 79.1 in., and special spring suspension gives it an overall height of 59 in.

plan. The total of Motor Products shares tendered by stockholders in exchange for a third-priority General Tire preferred issue was not particularly attractive to the latter.

Motor Products, which showed profits in 14 of the last 15 years, is confident that it will be back on a profitable basis this year. It incurred losses totaling \$716,346 in the quarter ended Sept. 30, 1954, compared with a profit of \$361,502 in the same period of 1953. The company is now said to have more than \$45 million in new automobile business in the U. S. and Canada, in addition to \$8 million in defense contracts.

Power Brake "Package" Offered by Chrysler

Due to the high demand for power brakes on automobiles, Chrysler Corp. is now offering a package of all the necessary components for field installation. It will be available for all Chrysler-built cars of 1951 through 1955 vintage and will retail for about \$46, excluding installation charges. Up until now, power brakes have been offered as factory-installed equipment only.

Buffalo Automobile Plants Set Many Records In 1954

Automobile plants in the Buffalo, N. Y., area wound up the year breaking all kinds of records. The Chevrolet engine plant, for example, turned out 660,000 engines last year, while the Ford assembly plant produced about 85,000 cars in 1954, 10,000 more than in 1953.

Oldsmobile Four-Door Hardtops Priced Above Two-Door Coupes

Oldsmobile's new four-door hardtop series (see AI, Jan. 1, page 35) will carry a factory list price approximately \$67 higher than that for the standard two-door Holiday coupes. Scheduled for production in March, the new cars will sell for \$2,322 in the 88 Holiday Series, \$2,541 in the Super 88, and \$2,864 in the 98 Series.

The hardtop model is distinguishable from the standard four-door in that it has no center post supports above the belt line between the front and rear windows. Other basic differences are a chrome roof bow across the headlining and different upholstery treatment.

News of the AUTOMOTIVE



TWO MOTORAMA STATION WAGONS ON MARKET

Shown at last year's GM Motorama (see *AI*, Feb. 1, 1954, page 57), the Chevrolet Nomad station wagon (top photo) has now been put into production. The two-door body is of steel construction and is mounted on a conventional Chevrolet chassis. The car will be available with V-8 or six-cylinder engines, Powerglide transmission, manual shift and overdrive, and most other options. In the bottom photo is shown the Pontiac Safari station wagon, which made its debut at the recent 1955 version of the GM Motorama. Only 59 in. high, the two-door Safari is mounted on a 122-in. wheelbase, has an overall length of 204.3 in., and is powered by the 180-hp Strato-Streak V-8 engine. Listing for \$2714 (Pontiac, Mich.), it is scheduled for early production.

GM Officials View 1955 as Epic Year for Industry

Speaking at a luncheon and press conference preceding the opening of the 1955 GM Motorama in New York City last month, Alfred P. Sloan, Jr., chairman of the board of General Motors Corp., and Harlow H. Curtice, GM president, both painted an optimistic picture of the outlook for this year for the national economy as a whole, as well as for General Motors.

Vital Role of Suppliers

While stressing that excellent opportunities for suppliers to the automobile industry lie in continued development of new modernizing equipment, such as electronically controlled devices and automatic machinery to make industry production facilities efficient and up-to-date, Mr. Sloan pointed out that it took GM 32 years to turn out its first 25 million cars, but only 14 years to make the second

25 million. He went on to estimate that the third 25 million cars will be produced in less than eight years, due in part to the modern machinery and production methods developed in recent years.

Mr. Sloan also pointed out that GM has spent \$3.5 billion for expansion and development since the end of World War II. These expenditures, he stated, were financed through depreciation and through \$2 billion in earnings.

Output of 6.8 Million Vehicles

Mr. Curtice lead off his address with a cheery prediction that gross national product will be in the area of \$370 billion this year, an increase of about three per cent over the estimated level for 1954 and somewhat in excess of the record reached in 1953. The high level of employment

will be maintained this year with the work week somewhat longer than it was in 1954. Personal income will increase and customer disposable income will be at a record high, he said.

He went on to say that the automobile industry should produce and sell in the domestic market approximately 6.8 million passenger cars and trucks during 1955, provided labor peace prevails. In addition, Canadian production and exports to other markets should bring total unit production to 7.6 million cars and trucks.

As far as General Motors itself is concerned, Mr. Curtice forecast that 1955 unit sales of GM passenger cars will be the highest in the corporation's history and that total dollar sales will again approximate \$10 billion. He expressed his confidence that this figure will be attained in spite of the fact that GM defense deliveries will continue to decline.

As an interesting sidelight, Mr. Curtice pointed out that it cost General Motors \$600 million to bring its 1955 models to market, nearly twice as much as was spent to introduce its 1954 models. A further indication of the financial lengths to which GM is going to maintain industry leadership was found in Mr. Curtice's statement that the \$1 billion expansion program, which he announced at the GM Motorama a year ago, has now grown to \$1.5 billion.

Capital expenditures for the program during 1954 reached a total of \$750 million, and outlays for 1955 are estimated at 500 million. A balance of \$250 million will be spent in 1956. In addition, \$2 million more will be spent for modernization and expansion in Europe.

Packard and Studebaker Link Their Canadian Operations

Merger of Packard and Studebaker activities in Canada will result in expanded dealer sales and service facilities similar to those accomplished by the two companies in the U. S. The new company known as Studebaker-Packard Corp. of Canada, Ltd., was formed just about five months after Packard and Studebaker merged.

AND AVIATION INDUSTRIES



DEATH CLAIMS MOTCH

E. Franklin Match, 46, president and treasurer of The Match & Merryweather Machinery Co., died Jan. 6, at Shaker Heights, O. Son of one of the three founders of Match & Merryweather, Mr. Match was also a director of Baker Brothers, Inc., Giddings & Lewis Machine Tool Co., and Gauld & Eberhardt, Inc.

Nash Calif. Plant To Build Ramblers

The Nash plant in El Segundo, Calif., which was shut last August for inventory, will be back in production on Feb. 14. According to present plans, it will be used to build Rambler cars only.

The plant previously turned out both the Rambler and Nash models. It will supply Ramblers to both Nash and Hudson dealers in six western states and will turn out about 90 cars a day at full capacity.

Hudson Looks for Sales Of 125,000 Cars in '55

Hudson is confident that it will strengthen its position in the industry this year, and is looking forward to sales of 125,000 cars. If it reaches that goal, it would be nearly four times the number of automobiles Hudson sold in 1954 and represent one of its best postwar sales years. The division is adding new dealers and hopes to have 2000 sales outlets by this spring to handle the restyled Hudsons as well as the Rambler and Metropolitan series.

AAI TABLOID

Bendix Aviation Corp. has announced the formation of a new Aircraft Products Div. for its wholly owned subsidiary, Bendix-Eclipse of Canada, Ltd. . . . Kaman Aircraft of Canada, Ltd., has been formed at St. Catharines, Ont., by Kaman Aircraft Corp. to manufacture helicopters.

Dana Corp. has announced a diversification program for its Pottstown, Pa., plant to center primarily around general subcontracting work.

Denham & Co., 20-year-old Detroit industrial advertising and public relations agency, has been incorporated.

General Electric Co. will build a new \$20 million plant near Hickory, N. C., for the manufacture of distribution transformers . . . Ethyl Corp. plans to erect at Sarnia, Ont., Canada, a plant to manufacture anti-knock compounds.

First flight of an experimental magnesium aircraft, built by East Coast Aeronautics, Inc., is expected to take place this month . . . Ryan Aeronautical Co. has been awarded an Air Force contract to develop a jet-powered vertical take-off plane.

Negotiations are being conducted by Hooker Electrochemical Co. and Durez Plastics & Chemicals, Inc., regarding a merger of Durez with Hooker.

Pennsylvania Salt Mfg. Co. has already opened a new plant at Delaware, O., and will dedicate another this month at Chicago Heights, Ill. . . . Lester Castings, Inc., has opened a new die casting plant at Bedford Heights, O.

Gyrodyne Co. of America, Inc., and Hiller Helicopters, Inc., have received contracts totaling \$400,000 for development of one-man, portable helicopters. . . . McDonnell Aircraft Corp. has awarded Lear, Inc., a contract for a new pictorial altitude system for the F3-H Demon plane.

The Canadian branch of the British Hawker-Siddeley Aircraft Co. will build a new supersonic jet fighter. A new type of jet engine will reportedly be developed also.

India is said to be negotiating with General Motors Corp. for the manufacture of Chevrolet passenger cars in that country.

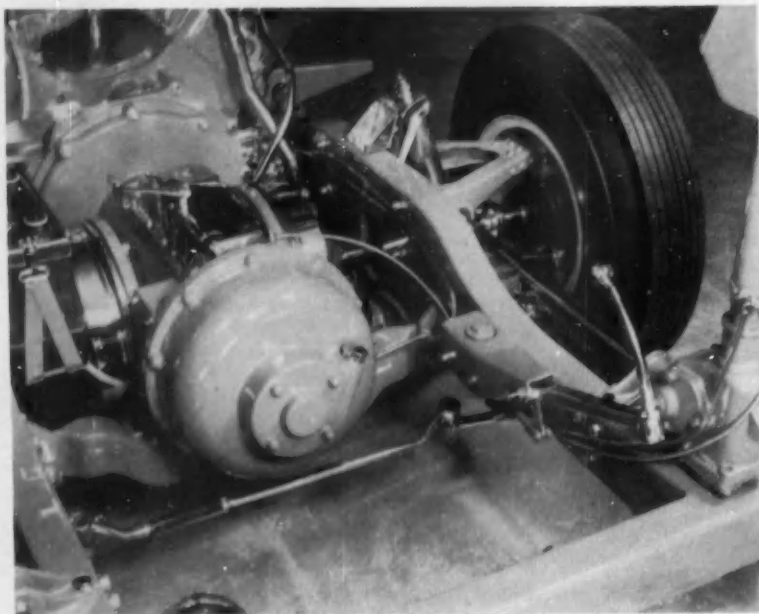
Armco Steel Corp. has developed a new type of aluminum-coated steel . . . General Electric Co. has announced a new thrust spoiler for J47 jet engines, said to reduce space required for jet aircraft landings.

Bell Aircraft Corp. has purchased Hydraulic Research & Mfg. Co., Burbank, Calif. . . . Denison Engineering Co. has acquired Delaware Industries, Inc., Delaware, O. . . . Ludlow Valve Mfg. Co. has purchased Rensselaer Valve Co., Cohoes, N. Y.

Conroy Associates, Detroit public relations organization, is now operating as a subsidiary of William Hart Adler, Inc., Chicago advertising agency.

The Guided Missiles Div. of Fairchild Engine & Airplane Corp. is expanding its Reinforced Plastics Dept. It has leased a new plant in Copiague, N. Y., for design and production of plastic items, including missile parts.

News of the AUTOMOTIVE



GMC ALL-PURPOSE TRUCK CHASSIS

Close-up of the front end of the chassis of the GMC L'Universelle "dream" truck discloses the inverted Hydra-Matic transmission, the fluid coupling, brake drums on the driving shafts as they come out of the gear box, and constant-velocity universal joints. The panel delivery vehicle was displayed, along with seven experimental passenger cars, at the recent GM Motarama in New York City (see *AI*, Jan. 15, page 58).



DUPLEX TRUCK IS POWERED BY DEUTZ DIESEL ENGINE

The new Duplex Model R-D-3-61 truck of 60,000 GCW is built on a 144-in. wheel-base. Power plant is a Deuts aircooled, V-8 Diesel engine of 649 cu in. displacement with an output of 170 hp at 2300 rpm. (see *AI*, Dec. 15, 1954, page 106). Bore is 4 1/2 in., stroke is 5 1/2 in., and five main bearings, cylinder heads, and cylinders are individually removable. Other equipment includes: Fuller transmission; Lipe Rollway clutch; Spicer universal joints; Timken axles; Ross steering gear; Westinghouse air brakes; and numerous Bosch components in electrical and fuel systems.

Jet Aircraft Sent Skyward From Zero-Length Launcher

A mobile launching platform, engineered by The Glenn L. Martin Co. and the Air Force, is now being tested for launching jet aircraft like guided missiles. The first successful launching took place at Edwards Air Force Base, Calif., recently.

The technique is similar to that used for the Martin Matador guided missile with launching platforms being mounted on trucks for mobility. Arms attached to the platform raise the fighter to the launching angle, and, with jet engine at full throttle and the added thrust of a booster bottle, the fighter is immediately airborne. On take-off a peak acceleration of about four G's is reached.

Planes used for initial flights were Republic F-84-G Thunderjets. They were modified so that booster bottles could be attached under their tail sections.

Bell Aircraft Is Developing Turbine-Powered Helicopter

Bell Aircraft Corp. has disclosed that it is working on an experimental turbine powered military helicopter. The new plane is designated the X-H13F.

The company has also stated that two new commercial helicopters previously announced will be put on the market this year. They are the 47H and 47J—deluxe versions of the standard Model 47—and will be aimed principally at the executive transport market.

"Package" Torque Converter Is Offered by Borg-Warner

A complete "package" industrial torque converter will be offered this year by Borg-Warner Corp. It has set up a new operation for producing all the necessary components at its Long Mfg. Div. in Detroit.

A major supplier of torque converters to the automobile industry, B-W will offer the package unit to manufacturers of such equipment as hoists, cranes, cement mixers, rigs and trucks. They will be available in diameters up to 26 in. for industrial engines with ratings of up to 500 hp.

AND AVIATION INDUSTRIES

Baker Bros. Acquires Hall Automotive Line

Baker Brothers, Inc., has acquired certain of the assets of the Hall Automotive Equipment Line of the Waterbury Tool Div. of Vickers, Inc. Production of Hall valve seat grinding machines and allied equipment has been transferred from Waterbury, Conn., to Toledo, O., where it will be carried on under the name Hall-Toledo.

G. V. C. Baker has been named vice-president in charge of Hall-Toledo, and Milo C. Gray, formerly sales manager of the Automotive Department of Waterbury Tool, will be general manager.

Cost Factor Main Issue In New Highway Program

Cost apportionment is the most sensitive single issue related to the highway modernization program proposed to Congress by President Eisenhower.

Splitting the costs of this operation equitably among Federal, state and local governments is a basic part of the financing task; and financing, as seen by Rep. George A. Dondero (R., Mich.), is the "toughest problem" to be faced in creating a road and street system adequate to heavier traffic needs.

The ranking minority member of the House Public Works Committee, Rep. Dondero told the U. S. Chamber of Commerce National Conference on Highway Financing last month that, given enough money, the country can build highways and streets which will accommodate all types of users in safety.

Congress is to provide a start this year on an expanded program of highway building and improvement. There is no firm evidence, however, that many states are prepared to dig up the funds to begin a 10-year operation that could cost their governments and local governments more than \$25 billion.

Dr. Frederick H. Guild, research director for the Kansas Legislative Council, emphatically told the financing conferees that he sees little chance of putting the state portion of the

CHEVROLET AND FORD FIGHT CLOSE BATTLE TO FINISH 1954 New Passenger Car Registrations*

Arranged by Makes in Descending Order According to the 1954 Eleven Months' Totals
ELEVEN MONTHS

MAKE	November 1954	October 1954	November 1953	Units		Per Cent of Total	
				1954	1953	1954	1953
Ford	90,287	113,072	100,007	1,234,388	1,010,684	29.16	19.05
Chevrolet	104,274	91,140	100,760	1,225,395	1,250,480	24.97	23.68
Buick	29,715	42,357	35,141	464,474	427,561	9.47	8.03
Oldsmobile	24,820	30,992	18,329	366,318	284,370	7.51	5.34
Plymouth	19,918	16,549	47,271	336,815	583,228	6.86	10.30
Pontiac	36,197	19,630	26,378	316,019	360,631	6.48	6.77
Mercury	16,570	19,465	29,009	251,834	259,795	5.13	4.88
Dodge	11,903	11,115	19,678	136,486	270,737	2.76	5.06
Cadillac	5,961	8,129	6,761	86,908	69,179	1.87	1.67
Chrysler	7,556	8,778	10,955	88,705	141,714	1.81	2.66
Studebaker	9,679	6,467	10,219	86,727	160,740	1.77	2.83
Nash	5,745	6,719	6,253	77,170	129,607	1.57	2.43
De Soto	5,880	5,276	8,952	67,966	112,694	1.39	2.12
Packard	2,426	2,822	3,156	26,886	67,906	.78	1.28
Lincoln	2,413	2,809	1,490	33,765	26,686	.69	.89
Hudson	2,810	2,672	4,267	32,644	62,829	.87	1.16
Willis	1,236	1,294	2,109	16,748	40,476	.34	.76
Kaiser	721	895	772	8,756	22,095	.18	.41
Misc. Domestic	56	142	381	3,287	12,707	.07	.24
Foreign	2,462	2,324	1,741	22,804	27,217	.46	.51
Total—All Makes	361,061	395,943	480,311	4,907,137	5,325,082	100.00	100.00

* Based on data from R. L. Polk & Co.

overall program across in the next two years.

Most controversial of the matters discussed at the conference in Washington was that of the position of toll roads in the highway building scheme. Opposite viewpoints were voiced by Kermit B. Rykken, special assistant to the executive vice-president, American Automobile Association, and H. E. Bailey, general manager of the Oklahoma Turnpike Authority.

Mr. Rykken adhered to his associa-

tion's position that "toll roads are not the answer to our highway problem" and that "the interstate system should be toll free." Mr. Bailey, on the other hand, proposed that total responsibility for the interstate road system be given to a "national turnpike authority."

Well over 300 persons, including investment bankers and Federal Government officials, attended the financing conference. Represented were 30 states and 67 cities.

FORD, WILLYS TRUCK SHOW PERCENTAGE GAINS OVER 1953 1954 New Truck Registrations*

Arranged by Makes in Descending Order According to the 1954 Eleven Months' Totals
ELEVEN MONTHS

MAKE	November 1954	October 1954	November 1953	Units		Per Cent of Total	
				1954	1953	1954	1953
Chevrolet	23,791	24,722	22,383	270,660	308,567	35.52	36.58
Ford	17,531	21,843	27,753	245,753	241,014	32.24	27.97
International	7,200	8,796	6,490	77,376	99,120	10.16	10.34
G.M.C.	6,294	5,215	5,490	61,807	77,325	6.11	6.97
Dodge	5,173	5,165	5,332	55,182	76,196	7.24	8.64
White	549	1,045	1,020	6,572	11,346	1.26	1.32
Studebaker	656	534	1,209	6,249	21,505	1.21	2.90
Willys Truck	1,473	1,411	845	6,664	7,928	1.14	.92
Willys Jeep	695	694	700	6,674	9,455	.90	.98
Mack	534	492	465	5,591	6,432	.73	.75
Diamond T	219	205	232	2,433	3,150	.32	.37
Reo	175	217	238	2,124	3,263	.28	.36
Brockway	122	141	190	1,232	1,929	.16	.22
Autocar	71	90	95	993	1,608	.13	.19
Misc. Domestic	369	531	445	4,364	5,445	.56	.64
Foreign	63	68	21	560	282	.05	.03
Total—All Makes	64,735	71,254	72,096	782,216	961,653	100.00	100.00

* Based on data from R. L. Polk & Co.



**"We're getting
as much as
75% LONGER
LIFE
from our deep
hole drills"**

RIFLE DRILLING machine in plant of O. F. Mossberg & Sons Company, New Haven, Connecticut. Stock is gun barrel steel, 25 inches long. Using *Texaco Sultex Cutting Oil A*, rate of feed is 6 inches per minute, with speeds up to 750 surface feet per minute. The company also uses *Texaco Sultex Cutting Oil A* in machining other steels, including aircraft alloys, with excellent results.

**— says Swan Esborn,
Chief Engineer,
O.F. Mossberg & Sons Co.,
New Haven, Connecticut**

"WHEN you're drilling shotgun and rifle barrels," says Mr. Esborn, "it's important that tools stay sharp. Over the years we've tried various cutting fluids, but the one we prefer and use exclusively is *Texaco Sultex Cutting Oil A*. It gives us as much as 75% longer life between drill grinds and excellent finish. Our rate of feed is better than the average for the industry. Production is consistently high."

Benefits like these are the rule wherever Texaco is

on the job. There is a complete line of *Texaco Cutting, Grinding and Soluble Oils*—and *Texaco Lubrication Engineering Service* to help you select the proper ones to do all your machining better, faster, and at lower cost.

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TUNE IN: *TEXACO STAR THEATER* starring DONALD O'CONNOR or JIMMY DURANTE, on TV Sat. nights. *METROPOLITAN OPERA* radio broadcasts Sat. afternoons.

Men in the News



Plymouth Div., Chrysler Corp.—William L. Martin has been named sales manager, and Bruce E. Miller has been advanced to director of advertising.



Studebaker-Packard Corp.—Walter R. Grant and E. E. Richards have assumed their duties as vice-president in charge of finance and treasurer, respectively.



Niles-Bement-Pond Co.—James D. Allan is now director of machinery sales and John C. Molinar has been made vice-president and general sales manager.

Willys-Overland Export Corp.—J. C. Delaplain has been appointed vice-president and general manager.

Chrysler Corp.—H. F. Diegel was elected comptroller.

Pontiac Motor Div., General Motors Corp.—William H. Taylor, Jr., has been named assistant advertising manager.

Chrysler Corp. of Canada, Ltd.—G. Allan Foran is now secretary.

Ford Motor Co.—V. Y. Tallberg was named executive assistant to the vice-president of engineering, and George E. Altmansberger was made director of engineering administration.

Delco Products Div., General Motors Corp.—J. N. Tilbrook has become defense contract administrator. Frank G. Carpenter succeeds him as general sales manager.

Budd Co.—Halton A. Coward and Ernest R. Schmidt have been made executive vice-presidents; and J. G. Richard Heckscher has been named vice-president.

Electric Auto-Lite Co.—Harold E. Hasemeyer has been appointed vice-president in charge of production, succeeding Byron A. Fay, retired. George Kessel is now manager of the Lockland, O., plant.



Tuthill Spring Co.—W. F. Fischer has been appointed general sales manager.

Ford Motor Co.—James O. Wright has been appointed director of purchasing.



Gisholt Machine Co.—The following executives have retired: Alfred B. Morey, vice-president and treasurer; F. M. Long, director of foreign sales; C. K. Swafford, vice-president; U. S. James, Detroit sales office manager; and Harold Earl, Moline sales office manager. H. A. Wadell was elected treasurer, and Arthur B. Morey was appointed assistant treasurer. E. K. Baxter and Robert Wellman were named managers of the Detroit and Moline sales offices.

Pratt & Whitney Div., Niles-Bement-Pond Co.—A. S. Burgoyne has been promoted to manager of domestic gage sales; A. F. Miller, Jr., manager of domestic cutting tool and precision parts sales; and J. B. Wilkie, assistant manager of the Cutting Tool and Gage Divs.

Republic Aviation Corp.—John A. Thompson was elected secretary, and George B. Estes has been appointed chief industrial engineer.



General Electric Co., Aircraft Gas Turbine Div.—J. S. Parker was named general manager.



Chevrolet Motor Div., General Motors Corp.—B. H. Holmes has been made assistant chief engineer.

Necrology

Ronald S. Mackinnon, 74, former sales manager of McLaughlin Carriage Co., which later became General Motors of Canada, died Jan. 7, at Toronto, Ont.

Lionel S. Marks, 83, leading authority on engine design and pioneer in internal combustion engine development, died Jan. 6 at Cambridge, Mass.

Gunnar Berg, 55, specialty products manager of Westinghouse Electric International Co., died Jan. 7, at Teaneck, N. J.

Louis Wilson, Sr., 72, automotive and aviation inventor, died Jan. 7, at Buffalo, N. Y.

Harry W. Trump, 63, southwest district manager of the Industrial Div. of Timken Roller Bearing Co., died recently, at Dallas, Tex.

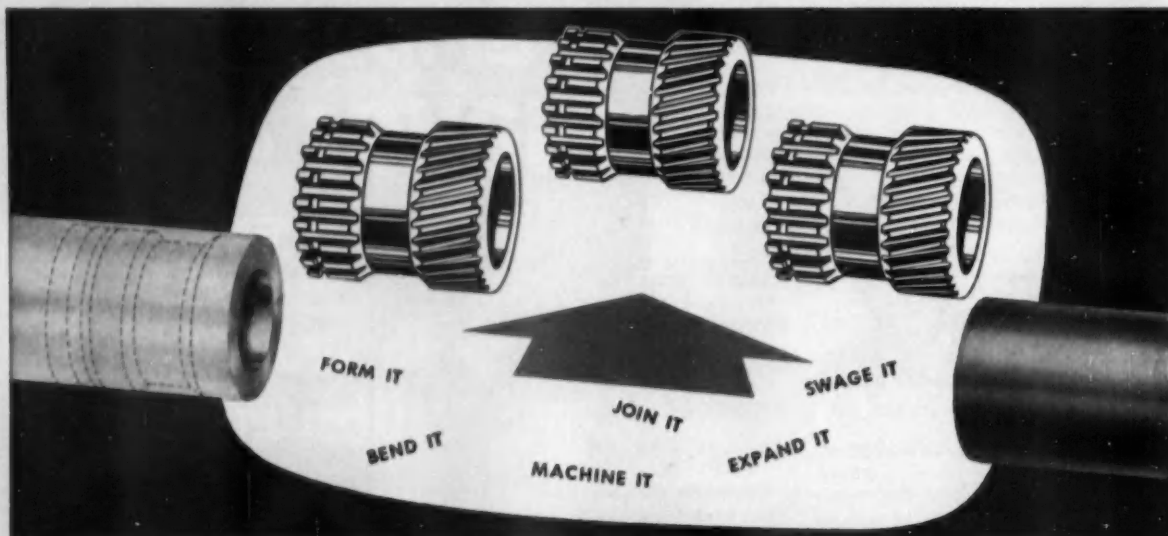
August S. Dusenberg, 75, builder of the famous automobiles and race cars bearing his name, died Jan. 18, at Indianapolis, Ind.

W. L. P. Althouse, 87, a founder of General Motors Corp., died Jan. 18, at Pasadena, Calif.

SERVICE with **B & W** CARBON STEEL SEAMLESS MECHANICAL TUBING

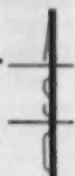
A	AVAILABILITY
S	SERVICE
Q	QUALITY

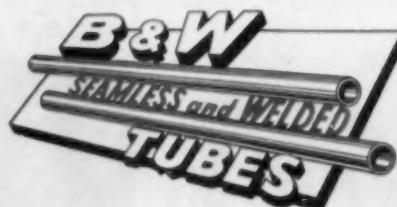
Saves You Time and Money



B&W SERVICE INCORPORATES:

- 1 Special engineering assistance on fabricating problems and procedures.
- 2 Mutual understanding between B&W and its tubing customers.
- 3 A nationwide network of district sales offices and distributors, both manned by experienced tubing salesmen.

remember  is meant for you

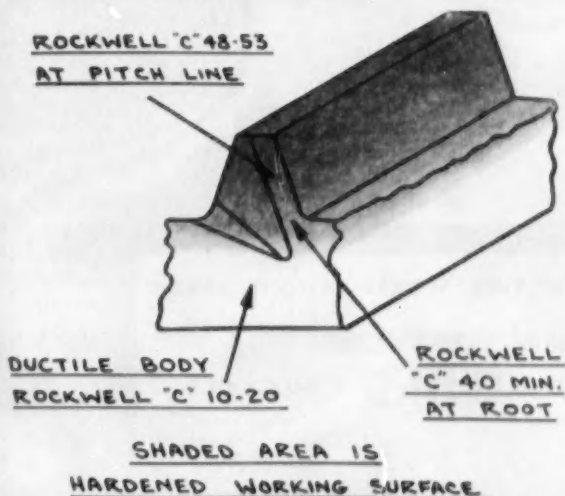


**THE BABCOCK & WILCOX COMPANY
TUBULAR PRODUCTS DIVISION**

Beaver Falls, Pa.—Seamless Tubing; Welded Stainless Steel Tubing
Alliance, Ohio—Welded Carbon Steel Tubing

TA-4050 (CSM)

THIN! TOUGH! ...and "tender-hearted"



THE MANUFACTURE of flywheel ring gears poses special problems. Sectional thickness is usually less than three-quarters of an inch. To withstand the impact force of the starter pinion, the gear teeth must be hard. But the gear body itself should be unhardened so that it will conform tightly to the flywheel, and "give" under the stress that might snap a brittle gear.

Note how DOUBLE DIAMONDS are made to be thin, tough, "tender-hearted." The above photo of a gear twisted into a pretzel shape graphically demonstrates ductility. The sketch at right shows three important

areas: the wide and deep hardness pattern, the generous area of transition, and the ductile body. These extremes are achieved in DOUBLE DIAMOND Flywheel Ring Gears by controlled selective heat treatment—all essential to flywheel ring gears that provide the best possible performance.

Our Engineering Department will be glad to make constructive suggestions on the design of flywheel ring gears, or on the many other types in which we specialize. Write, phone or wire—depending on the urgency of your need.



FOR AUTOMOTIVE, FARM EQUIPMENT AND GENERAL INDUSTRIAL APPLICATIONS
GEAR-MAKERS TO LEADING MANUFACTURERS

Automotive Gear Works, inc.

ESTABLISHED IN 1914

RICHMOND, INDIANA

... IF IT'S A HIGH PRODUCTION PROBLEM ...

ASK



BAIRD

ABOUT IT



ANOTHER WORLD-FAMOUS PLANT
INSTALLS BATTERY
OF **BAIRD** CHUCKERS

The photo above shows four of a battery of eight Baird 6-spindle automatic Chucking Machines performing the complete turning operations on aluminum alloy pistons . . . including automatic feed and discharge.

The Plant Manager says, "Previous methods of finish-turning required *four* separate operations. Now, the same results are attained in one operation . . . faster and with less chance of error." Cutting speed is 1332 to 1350 ft. per minute . . . feed per revolution .018 to .025. Actual cutting time at each station approximately 5 seconds . . . complete cycle 7.36 seconds.

Baird Chuckers are designed and built to insure positive, continuous, production . . . tooled for precision at low unit costs that give you a definite, competitive advantage.

As automation of large plants advances, Baird automatics can play a vitally important part in your production lines. And Baird engineers, highly experienced in special tooling techniques, offer you solutions for tough production problems. It will pay well to "ask Baird about it."

Write to Dept. AI

GBA54

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ON THESE ESSENTIAL PRODUCTION PROBLEMS:

AUTOMATIC MACHINE TOOLS • AUTOMATIC WIRE & TUBING METAL
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EATON Free-Valves LAST LONGER*

Free Floating Action—

- Wipes stem and seat free of deposits
- Keeps a film of oil on stem and guide surfaces
- Prevents scuffing
- Prevents burning and guttering
- Reduces wear
- Eliminates hot spots due to local leakage



Performance records covering engines of all types in all kinds of service prove that Eaton Free-Valves increase valve life many times over the ordinary life expectancy of conventional valves.

Eaton Free-Valves can be applied to engines of all types and sizes, without costly design changes. Our engineers will be glad to discuss Eaton Free-Valves with you.



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PRODUCTS: Sodium Cooled, Poppet, and Free Valves • Tappets • Hydraulic Valve Lifters • Valve Seat Inserts • Jet Engine Parts • Rotor Pumps • Motor Truck Axles • Permanent Mold Gray Iron Castings • Heater Defroster Units • Snap Rings • Springtites® • Spring Washers • Cold Drawn Steel • Stampings • Leaf and Coil Springs • Dynamatic Drives, Brakes, Dynamometers

OSTUCO

internally upset tubing processes faster

Saves \$4.95
per unit



Landing gears, manufactured by The Cleveland Pneumatic Tool Company for North American Aviation's F-86H, have piston tubes machined from internally upset OSTUCO tubing. The upset construction of these *special-quality* OSTUCO tube forgings keeps machining to a minimum and permits faster processing. Savings are 25% . . . or \$4.95 per unit.

Special-quality OSTUCO tubing produces stronger, lighter products . . . better looking products at greater savings. Its uses are practically unlimited. Wherever you use tubing in *any form*, OSTUCO's single source service can save you time and money. Write for helpful booklet "Ostuco Tubing," or better still, send us your blueprints for immediate quotation.

OSTUCO
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OSTUCO TUBING

SEAMLESS AND
ELECTRIC WELDED
STEEL TUBING
—Fabricating
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News of the MACHINERY INDUSTRIES

By Thomas Mac New

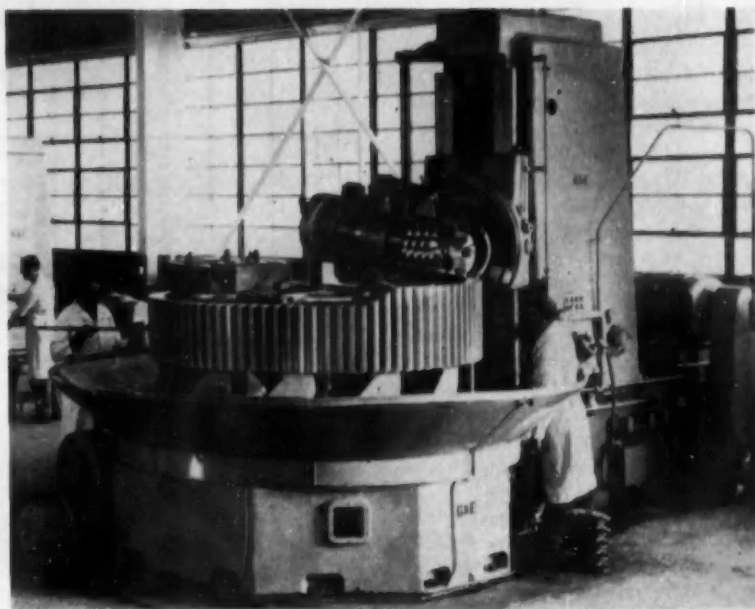
Increased Machine
Tool Business Ex-
pected During 1955
as Result of Plant
Modernization and
New Government
Orders

Machine Tool Industry Looks for Improvement

Although business in the machine tool industry was disappointing in November last year, the industry has high expectations for 1955. Much of its optimism is based on the fact that many manufacturers are buying new machine tools for the first time in years, and new business from the Government is foreseen.

The recent Government authorization to purchase \$150 million worth of long lead time or "elephant" tools for the military should pick up business somewhat this year. Bigger civilian orders, which the industry expects as a result of modernization, will add to the increased business.

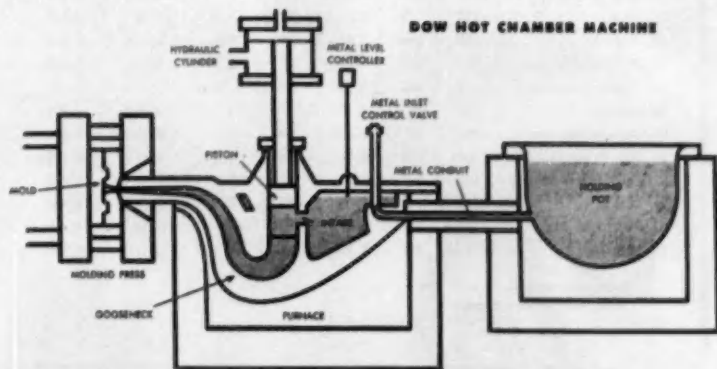
In Dayton, Ohio, Air Materiel Command personnel are working on specifications for \$84.6 million worth of the long lead time tools that will be bought by the Air Force. The specifications will contain performance characteristics to be expected for each type of tool. AMC will negotiate contracts directly with the machine tool builders when specifications are completed. When the preliminary specifications are prepared, tool builders will prepare engineering proposals on the equipment they wish to build and then AMC will develop final specifications. Tool manufacturers will then be asked to quote on the finalized specifications.



One of the largest machines of its kind in this country, a huge 132 in. Gould & Eberhardt heavy duty gear hobber, capable of doing precision work in gear blanks up to and including 132 in. diam, 3 1/2 in. C. P. and 54 in. face, has recently been added to the production facilities of Illinois Gear & Machine Co., Chicago. This gigantic gear hobber will cut spur, helical and worm gears to a tolerance of 0.0003 in. for maximum tooth spacing error, and to a tolerance of within 0.001 in. for the parallelism of the teeth. It will safely handle a work table load of 100,000 lb.

Statistics released by the National Machine Tool Builders Association show that November, 1954, orders dropped to the lowest level since May, 1950. The November figure totaled

\$35 million as compared with \$44 million the same month of 1953. Although figures are not yet available for December, the industry expects the final report to look a little more encouraging. It is estimated that new business booked in 1954 was down more than 35 per cent, amounting to about \$535 million against more than \$850 million in 1953.



Dow Has Hot Die Casting Method

A new die casting process has been developed by Dow Chemical Co. for magnesium parts. In the new system, known as the hot chamber process, is a continuous and automatic method in which molten metal is supplied by
(Turn to page 92, please)

New Highs Established in Horsepower and Torque

INSTEAD of relaxing, the BIG engine race has established dramatic firsts for 1955. Up to now the battle of the giants has been confined to the small group in the medium and high priced brackets. In 1955 the Big Three—Chevrolet, Ford, and Plymouth—make history by boosting horsepower of their new V-8's considerably above the level of all top engines of 1950. A search of the record (see AI, March 15, 1950) reveals that only Cadillac and the Packard Custom line boasted 160-hp in 1950; while the Buick Roadmaster and Lincoln were at 152.

The following year Chrysler zoomed to 180-hp. 1951 was the year of the big shift that started the avalanche.

The first of the bench marks for '55 is the rating of the Big Three: Ford and Chevrolet with 162-hp standard V-8's; Plymouth with a choice of 157 and 167. In addition, each of the three offers a hot rod package with special equipment, Ford topping these options with 182-hp.

The second bench mark is found in the top, top ratings (see Table 1): Packard Caribbean—275 hp; Cadillac Eldorado—270 bhp; Packard—260; Cadillac, Imperial, and Chrysler New Yorker—250.

The third phase may be easily the most significant: it is an industry-wide move to promote torque as the best criterion of acceleration, performance, safe passing on the highway. Values of torque, at moderate speeds, have been upped on every engine.

This emphasis on torque introduces a new dimension in sales and promotion and advertising. Torque is no mystery to the engineer. But it is completely foreign to everyone else. It will be necessary to educate sales department personnel, advertising people, and the consum-

By Joseph Geschelin

TABLE I

Comparative Data 1955 OHV V-8 PASSENGER CAR ENGINES

Make	BHP (max.)	Dis- placement (cu in.)	Ratio Bhp/cu in.	Torque (lb ft)	Com- pression Ratio	Bore/Stroke Ratio	Ratio Torque/cu in.
1. Cadillac Eldorado.....	270	331	0.816	345	9	1.05 to 1	1.042
2. Packard Caribbean.....	275	352	0.781	355	8.5	1.14 to 1	1.006
3. Cadillac.....	250	331	0.756	345	9	1.05 to 1	1.042
4. Chrysler New Yorker....	250	331	0.755	340	8.5	1.05 to 1	1.027
5. Imperial.....	250	331	0.755	340	8.5	1.05 to 1	1.027
6. Packard.....	260	352	0.739	355	8.5	1.14 to 1	1.006
7. Buick Series 50, 60, 70..	236	322	0.733	330	9	1.25 to 1	1.025
8. Dodge*	193	270	0.715	245	7.6	1.11 to 1	0.907
9. Studebaker President....	185	259	0.714	258	7.5	1.10 to 1	0.909
10. Buick Series 40.....	198	284	0.712	256	8.4	1.13 to 1	0.970
11. Clipper.....	225	320	0.703	325	8	1.09 to 1	1.015
12. Clipper Custom.....	245	352	0.696	355	8.5	1.14 to 1	1.000
13. DeSoto Fireflite.....	200	291	0.687	274	7.5	1.11 to 1	0.942
14. Plymouth*	177	260	0.681	231	7.6	1.10 to 1	0.886
15. Chevrolet*	160	265	0.679	260	8	1.25 to 1	0.981
16. Dodge Custom Royal....	193	270	0.679	245	7.6	1.11 to 1	0.907
17. Ford Thunderbird.....	196	292	0.678	266	8.5	1.14 to 1	0.979
18. Mercury Montclair.....	198	292	0.678	266	8.5	1.14 to 1	0.979
19. Ford*	182	272	0.669	265	8.5	1.10 to 1	0.985
20. Ford Thunderbird.....	193	292	0.661	280	8.1	1.14 to 1	0.959
21. Lincoln.....	225	341	0.660	342	8.5	1.13 to 1	1.003
22. Plymouth.....	157	241	0.652	217	7.6	1.08 to 1	0.900
23. Hudson Hornet.....	206	320	0.650	300	7.8	1.09 to 1	0.973
24. Nash Ambassador.....	206	320	0.650	300	7.8	1.09 to 1	0.973
25. Dodge.....	175	270	0.646	240	7.6	1.11 to 1	0.969
26. Mercury.....	198	292	0.644	274	7.6	1.14 to 1	0.930
27. Plymouth Belvedere....	167	260	0.642	231	7.6	1.10 to 1	0.886
28. DeSoto Fireflite.....	185	291	0.636	245	7.5	1.11 to 1	0.942
29. Pontiac.....	190	287	0.627	264	8	1.15 to 1	0.919
30. Chrysler Windsor.....	168	301	0.625	275	8	1.00 to 1	0.914
31. Olds 88 and Super 88... 202	324	0.623	332	8.5	1.13 to 1	1.025	
32. Studebaker Commander	162	259	0.622	250	7.5	1.10 to 1	0.965
33. Chevrolet.....	162	265	0.611	257	8	1.25 to 1	0.970
34. Ford.....	162	272	0.596	256	7.6	1.10 to 1	0.948
35. Olds 88.....	185	324	0.571	320	8.5	1.13 to 1	0.908

* With power package.

† With automatic transmission.

ing public. It will have to be done by explaining in familiar language—and by analogy with familiar things—before the idea can take hold. And it will have to be explained to the newspaper men and writers, who are the link with the buying public.

This year, too, marks the passing of all inline eights in the passenger car field as well as a reduction in the number of sixes. Nevertheless, sixes remain firmly entrenched with Ford, Chevrolet, and Plymouth where these engines constitute an important attribute for commercial vehicles, fleet and taxicab operations, and segments of the car buying public more interested in operating economy.

The swing to V-8's this year has been so dramatic that our yearly analysis is being confined exclusively to V-8's. Besides more than doubling the list of engines considered heretofore, Table 1 has been expanded in scope of characteristics as well. To indicate the design trend we have added a column on torque; one on bore/stroke ratio; and two special criteria (for what they may be worth)—the ratio of bhp/cu in., and the ratio of torque/cu in.

The yardstick of torque/cu in. was chosen deliberately out of two alternatives, the other being a calculation of bmep. The writer felt that torque/cu in. was more directly related to the comparison at hand.

Admittedly the latter two criteria are exercises in analysis since no attempt is made to relate them to a uniform set of conditions such as engine speed or gross vehicle weight. On the other hand, since so much emphasis is being placed upon horsepower and torque ratings, these ratios provide at least a measure of comparison—two flexible yardsticks.

It may be noted at this point that Table 1 is arranged in a descending order of values (Turn to page 104, please)

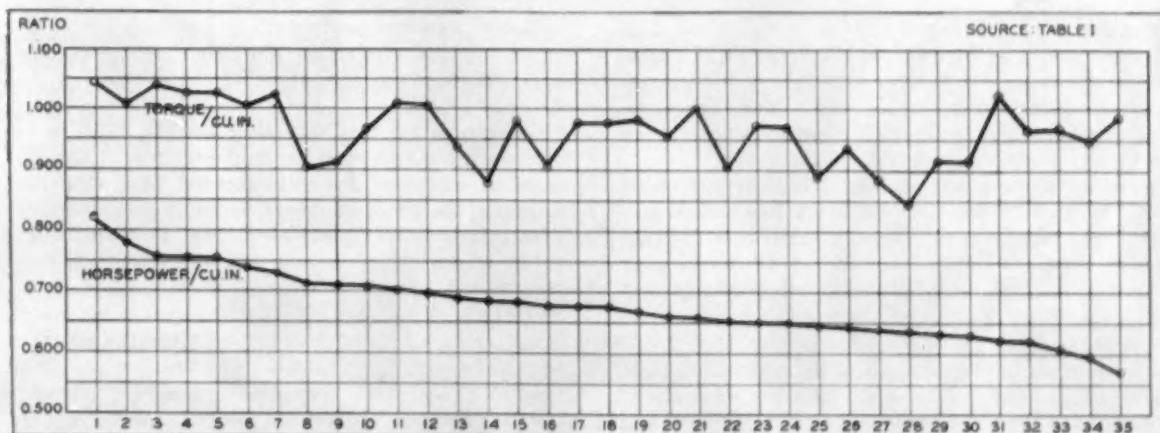
TABLE II
Comparative Ratings Torque/cu. in.
1955 PASSENGER CAR V-8 ENGINES

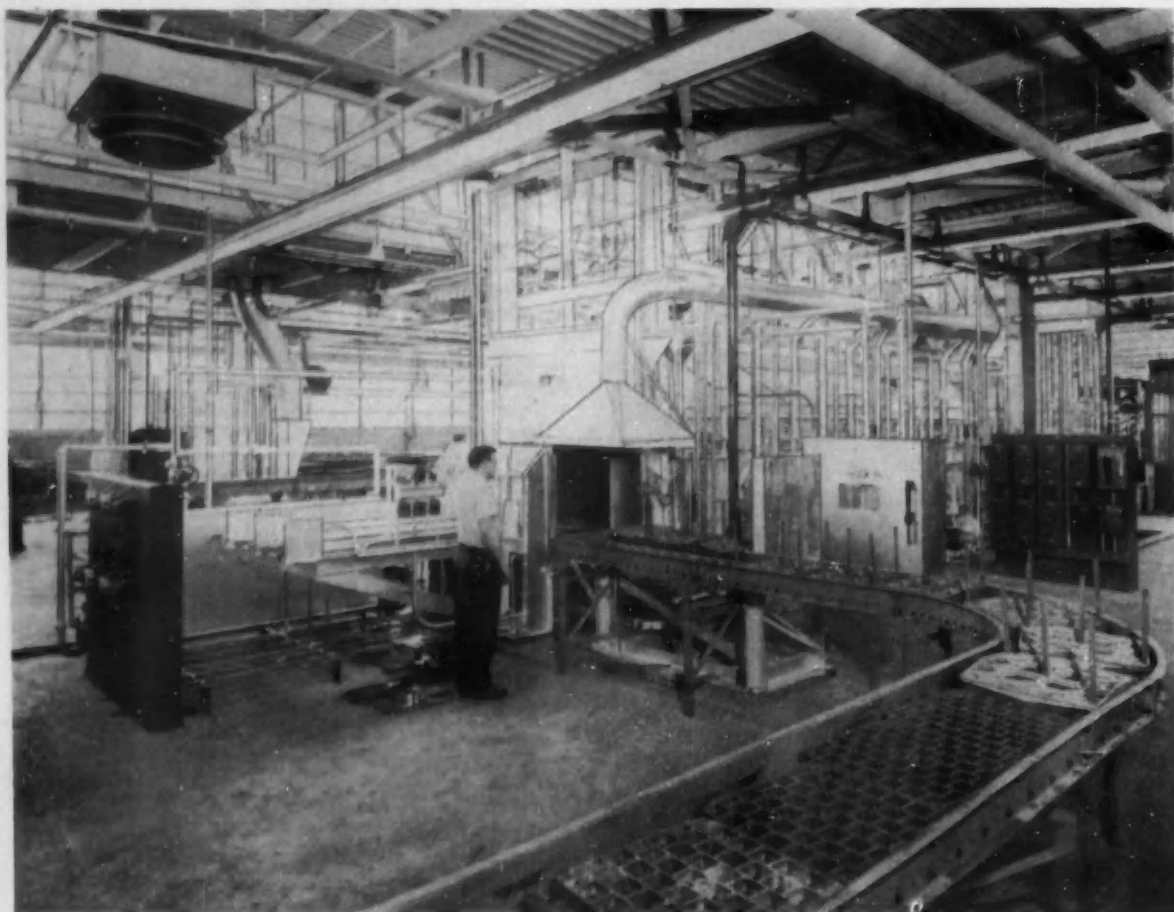
	Torque/cu in.	Ranking Bhp/cu in.
1. Cadillac Eldorado.....	1.042	1
2. Cadillac.....	1.042	3
3. Chrysler New Yorker.....	1.027	4
4. Imperial.....	1.027	5
5. Buick Series 50, 60, 70.....	1.025	7
6. Olds 98 and Super 88.....	1.025	31
7. Clipper.....	1.015	11
8. Clipper Custom.....	1.000	12
9. Packard.....	1.000	8
10. Packard Caribbean.....	1.000	2
11. Lincoln.....	1.000	21
12. Studebaker President.....	0.999	9
13. Olds 88.....	0.988	35
14. Ford*.....	0.986	19
15. Chevrolet*.....	0.981	15
16. Ford Thunderbird*.....	0.979	17
17. Mercury Montclair.....	0.979	18
18. Hudson Hornet.....	0.973	23
19. Nash Ambassador.....	0.973	24
20. Buick 40.....	0.970	10
21. Chevrolet.....	0.970	33
22. Studebaker Commander.....	0.966	32
23. Ford Thunderbird.....	0.969	20
24. Ford.....	0.949	34
25. DeSoto Fireflite.....	0.942	13
26. Mercury.....	0.938	26
27. Pontiac.....	0.919	29
28. Chrysler Windsor.....	0.914	30
29. Dodge*.....	0.907	8
30. Dodge Custom Royal.....	0.907	16
31. Plymouth.....	0.900	22
32. Dodge.....	0.888	25
33. Plymouth*.....	0.888	14
34. Plymouth Belvedere.....	0.888	27
35. DeSoto Fire dome.....	0.842	28

* With Power Package.

† With Automatic Transmission.

COMPARATIVE GRAPH—1955 V-8 ENGINES





Charge end of one of the pusher gas carburizers showing return conveyor arrangement with a long run on the other side of the furnace, extending into a loop through a washer and dryer to the left in this picture.

Heat Treating of Aircraft

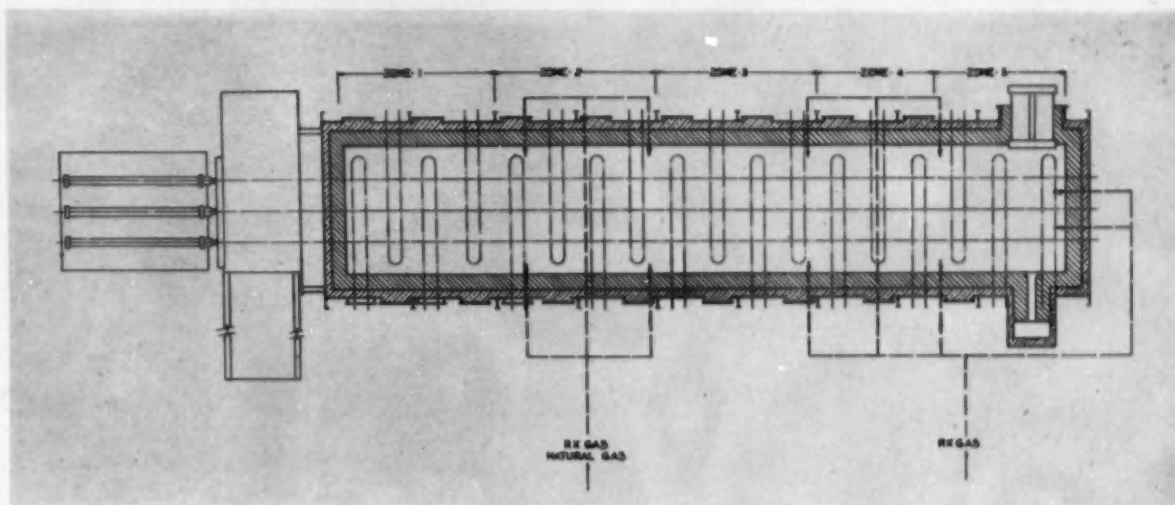
IN line with the overall picture of extremely rigid production and inspection standards in all phases of the aircraft industry, power gears for aircraft engines must be held to extremely close tolerances during all stages of production in order to achieve the maximum attainable strength-weight ratio.

Machining operations are highly critical on aircraft gears because of the superior finish found necessary for these applications. Due to the ever present "strength-weight ratio" problem, it is increasingly important that the right materials be used and that they receive the right heat treatment. Excellent results are obtained by using low carbon alloy steels with the teeth carburized and made very hard. High nickel alloys, such as the AMS 6260 and 6263 steels, are used for their deep hardening characteristics and

resulting excellent uniformity of core through varied cross sections. To attain the best machining structure, forgings are normalized in the as-received condition.

Tolerances are held very close and the finish on all machined surfaces must be completely free of any tool mark or scratches. It is also required that, after carburizing, the gears be slowly cooled to room temperature before reheating for hardening. If a heat treatment "misses" the first time the work often cannot be reprocessed.

To achieve the required close tolerances yet maintain large production rates at the Aircraft Gear Div. of Dana Corp., Fort Wayne, Ind., two Surface Combustion pusher tray controlled atmosphere gas carburizing furnaces are utilized. Each furnace has three



Plan view of continuous carburizer showing location of zones, thermocouples and prepared atmosphere inlets.

Great Care Necessary at Each Step in Carburizing, Cooling, Reheating, Quenching, Etc., of Shafts and Gears for Highest Strength-Weight Ratio

By C. A. Paynter, Chief Metallurgist
Aircraft Gear Division, Dana Corp.

Engine Gears

rows of work that pass between U-shaped, gas-fired radiant tube heating elements situated above and below the work. Each row is independently controlled and operated by a hydraulic pusher cylinder of constant stroke length, adjusted to any interval required.

In addition, the furnace contains a combination charge car and door, an inner charge door, a stripper, a push-out mechanism, an inner discharge door, and a discharge vestibule door. All motions with the exception of closing the charge car door and the discharge door are all automatically controlled by the cycle. The charge car is controlled by a push button and the discharge vestibule door by a foot switch. The charge vestibule is automatically purged when the charge door closes, and the discharge vestibule is automatically purged whenever the outside door is operated.

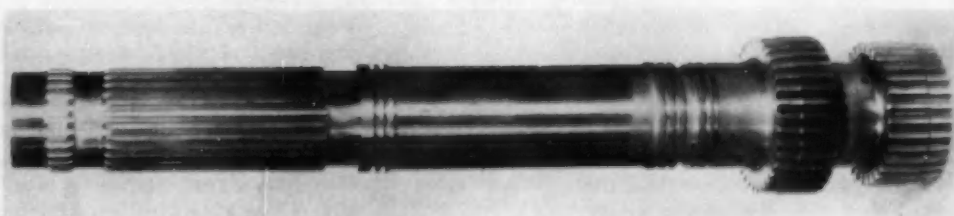
These three-row pusher gas carburizers provide several varieties of automatic operating cycles for varying case depth and production requirements. These basic variations are:

1. The same case depth on all three rows of work.
2. A different case depth on each row.
3. One case on any two rows, a different case on the other row.

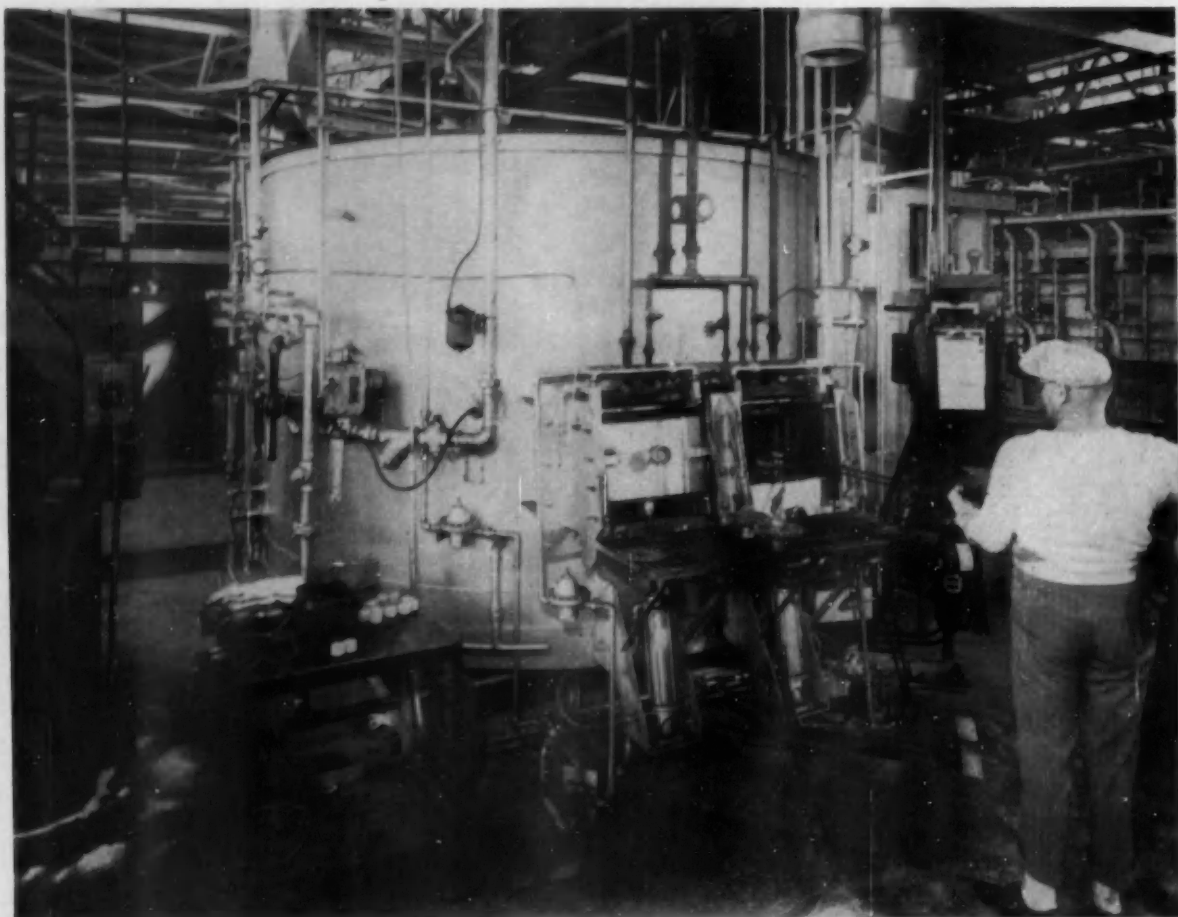
Three classes of case depths are produced with a surface concentration of 0.90 to 1.00 per cent C.

1. 0.020-0.030 in. 2. 0.030-0.040 in. 3. 0.055-0.065 in.

The capacity of each furnace is based on a gross production of 1036 lb per hr. The base cycle involves heating the work from cold to 1650 F, holding at this temperature until proper case and concentration are



Main impeller
shaft of AMS 6260
steel.



Rotary hearth controlled atmosphere furnace, one of three used for reheating for hardening. Quench presses and a special direct quench tank with elevator are within easy reach of operator

duly achieved and then cooling the charge to 800 F.

To achieve the required furnace cooling to room temperature after carburizing and before reheating for hardening, as required for aircraft gears and parts, the continuous gas carburizing furnaces are each divided into five zones of automatically controlled temperature — (1) - 1550 F; (2) - 1650 F; (3) - 1625 F; (4) - 1300 F; and (5) - 800 F. To circulate the atmosphere gases, Zones 2 and 3 have heat resisting alloy roof fans with water-cooled bearing assemblies.

In Zone 5, the trays of parts are cooled to about 800 F before discharging. Controlled cooling is accomplished in this indirect cooling zone by pulling air through the radiant tube heating elements with an exhaust fan. The fan is connected to the radiant tubes by a steel pipe manifold arrangement.

After cooling to proper temperature, the trays are pulled onto a return conveyor on which they are moved, by means of an air cylinder and pusher "dog" arrangement, to the unloading point. At this same point, the green parts are identified by heat treat code, loaded onto the previously emptied trays, and

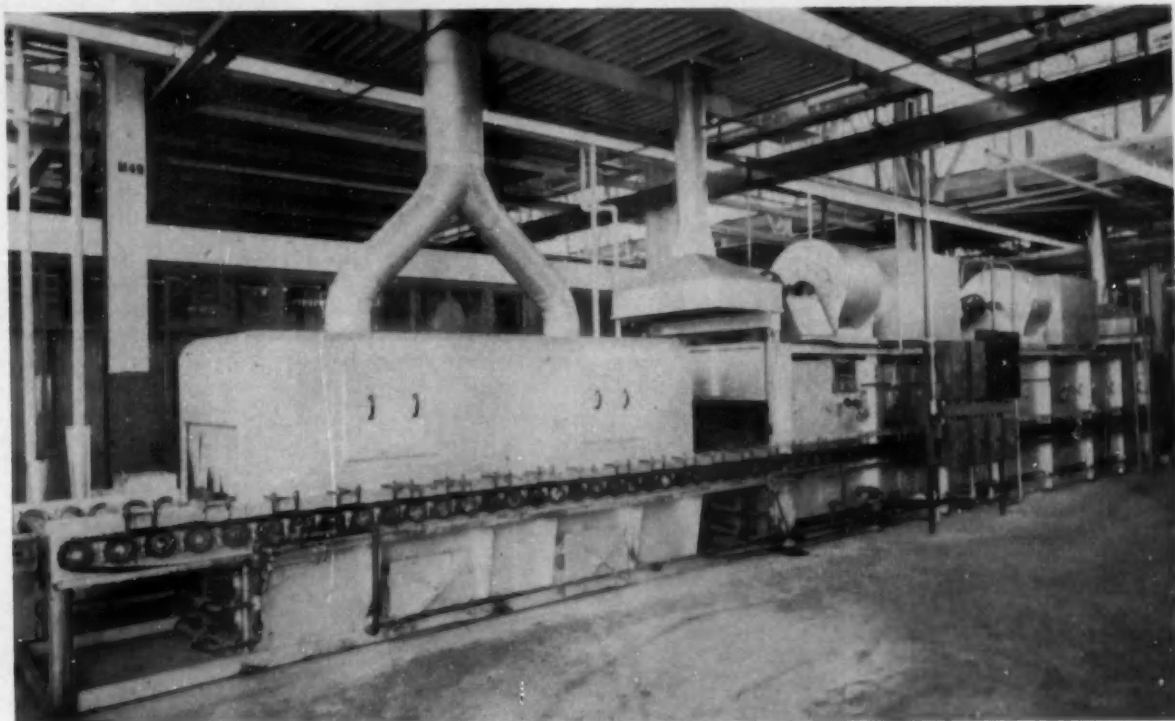
sent through a wash, rinse and dry before entering the carburizing furnace.

An average tray load of AMS 6260 steel gears would remain in the furnace about 12.5 hr from charge to discharge.

RX (endothermic) gas from a battery of generators is enriched with natural gas in Zone 2 and used straight in Zones 3, 4 and 5. A dewpoint will be + 23 F in Zone 2 and + 28 F in Zone 3.

The split manifold arrangement for furnace atmosphere supply provides an atmosphere of proper carbon potential to achieve the desired surface carbon concentration in the carburizing zones by introducing a mixture of RX carrier gas enriched with natural gas by an individual header and four inlets in Zone 2. The other header introduces straight RX gas to the diffusion zones of the furnace.

To maintain close control over the carbon potential of the furnace atmosphere, carbon concentration bars are run regularly. To check case depth, a test pin is pushed every two hours and adjacent work in the furnace assigned heat treat numbers keyed to that pin. These pins are then kept on file for reference.



Convection heated draw furnace tied into the rotary hardening furnaces by a power and gravity conveyor arrangement. Washer is in the foreground

Additional flat pins are also run periodically and are hardened and ground in a manner similar to the parts being controlled in order to check the potential Rockwell hardness before the production parts are actually reheated and quenched.

The continuous carburizing capacity is supplemented by two pit type Leeds & Northrup Homocarb furnaces with cooling pits. These furnaces provide a desired balance in the overall setup of carburizing equipment. Case depth is controlled by pulling test pins from the load at intervals during the cycle.

Practically all production through the carburizers has some areas copper plated (0.0006-0.0012 in.) to stop off the carburizing action. After carburizing and cooling, this copper is stripped before the parts are reheated for hardening except in instances where the copper plate covers areas that do not contact the quench dies. In these cases the parts go direct to a controlled atmosphere rotary hardening furnace in which the atmosphere is held in balance with the carbon content of the case.

Other parts are given a "flash" copper plate (0.0003-0.0006 in.) before hardening. These involve areas which will be either broached for splines or shaper cut in core hardened areas after hardening. When recessed core areas prove hard to plate, a copper "stop off" paint is used over the copper plate. The hardening operation on copper flashed parts is executed from a rotary furnace in which the dew point of the atmosphere is held at about 50 F.

Where intermediate machining is required, parts are given a stress relief, after carburizing. This op-

eration is carried out in a Surface Combustion controlled atmosphere rotary hearth furnace of the same type used in reheating for hardening. A DX (exothermic) atmosphere is used in this furnace, for the surface protection of the parts, as the furnace atmosphere is about 1290 F. In most cases this stress relief will bring the surface hardness of the cased areas down from about 45-50 Rockwell C to a reading of 25-30 Rockwell C.

Reheating for hardening is carried out in any of three Surface Combustion radiant tube equipped rotary hearth furnaces. RX prepared gas atmosphere is used in the heating chamber to protect the parts surface from scaling, sooting or decarburization.

Parts are placed on trays by the operator and pushed onto the rotating hearth through a foot-operated door. The hardening temperature is 1500 F and a tray of parts takes 80-90 min to move through the entire arc of travel before withdrawal through the other door. The heating cycle is slow in order to minimize distortion. The rate of discharge of the work is also geared to the Gleason quenching cycle. Approximately 85 per cent of the parts are die quenched, on one of several quench presses while the balance are direct quenched in oil on a special batch quench tank with a unique elevator arrangement.

Quenching oil, which must be kept in clean uniform condition for best results, is conditioned automatically in a central storage and cleaning system supplied by Bell & Gossett.

Each rotary furnace has five No. 16 Gleason presses
(Turn to page 92, please)

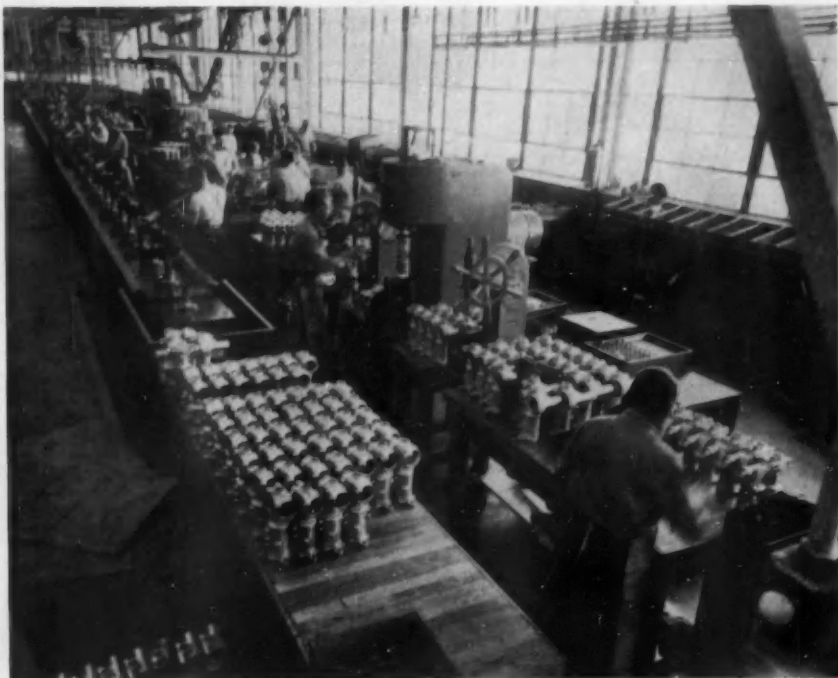
Coaxial Power Steering Gear Produced

on

Precision Equipment

By
Joseph Geschell

Here is a perspective of one side of the Chrysler power steering final assembly department, showing one of the two, 120-ft power conveyor lines. In the background are the sub-assembly benches, feeding the assembly line.



EACH new plant introduced on the automotive scene has evolved from some basic philosophy of manufacturing, reflecting the thinking and planning for a specific product. This is especially true of Chrysler Corporation's Trenton plant for producing coaxial power steering gear. By the very nature of the product, the machining and processing of individual components requires painstaking attention to quality control, and demands exceptionally fine tolerances on dimensions, as well as unusually fine surface finishes. Power steering mechanism is strictly a precision-made product.

In keeping with these requirements, the equipment found in this plant consists of makes and types noted for their ability to produce to fine dimensional tolerances.

At the present writing, the Trenton plant provides 171,205 sq ft of floor space for power steering manufacture and assembly. It includes some 413 items of new milling, drilling and boring, grinding, and honing machines, as well as 127 pieces of heat treating, impregnating, and shot blasting equipment.

Although Chrysler's coaxial power steering stems from a unique, basic design, the product is manufactured in two different sizes—one for Plymouth and

Dodge, the other for De Soto and Chrysler. While the principal difference between the two is in the size of the housing, from a production standpoint it is necessary to machine similar components of different sizes and this has resulted in the establishment of parallel lines of similar equipment, as well as two separate final assembly lines. Processing and quality control for both types are exactly the same.

This study is intended simply as a highspotting of some of the interesting operations on a group of selected parts. To cover the wealth of production detail of the entire operation would be quite beyond the scope of even a series of articles.

Before proceeding with details of the operation, it is of interest to note that the requirements of close dimensional tolerances and fine surface finishes have served to introduce a variety of precision-boring equipment, Micromatic honing machines for finishing bores, Jones & Lamson and Ex-Cell-O thread grinders, and an interesting array of broaching machines—for surface broaching, keyway broaching, and the unique Ex-Cell-O Scru-Broach for broaching the ball race in the connector.

Noteworthy, too, is the fact that all of the Sundstrand milling machines are equipped with carbide

tools and are run without cutting fluid. Milling is done at exceptionally high cutting speeds and feeds, removing metal at extremely high rates.

The largest component of the mechanism is the aluminum lower housing. In the machining of this housing, as well as the upper housing, Chrysler has elected to provide a basic system of location from two "construction" bands, machined at the upper and lower ends. Machined from the rough in Lo-Swing lathes, to close tolerances, these bands or pilots provide accurate locations for succeeding operations.

Preliminary machining is done in a group of special Buhr machines. The first of these, a two-way, six-station, trunnion type machine, handles the following operations: finish-mill the cover face; drill and tap three holes in the cover face; rough- and semi-finish semi-circle in cover face; finish face boss; rough- and semi-finish counterbore; rough- and semi-finish shaft bore.

Next in line is a Buhr, two-way, nine-station trunnion type machine that handles the housing lengthwise for boring from both ends. It performs the following operations: finish-face; rough- and finish-bore; rough- and semi-finish bearing and shoulder; form groove. On the opposite side: rough- and semi-finish-bore large diameter; semi-finish flanged end; other boring and facing operations; rough-form recess in cylinder bore; drill, chamfer, and tap three holes in flanged end.

The third Buhr machine is a vertical type special multiple-spindle drilling machine for drilling two holes; forming five spherical radii; milling five-deg and nine-deg angles on the pad.

Following some detail drilling operations, the housing is presented to a group of two Ex-Cell-O No. 112 Senior two-spindle precision-boring machines, followed by finish boring simultaneously from all surfaces in a special Ex-Cell-O four-way precision-boring machine. The latter handles a variety of stepped boring operations—including counterboring, chamfering, grooving, etc., as well as boring.

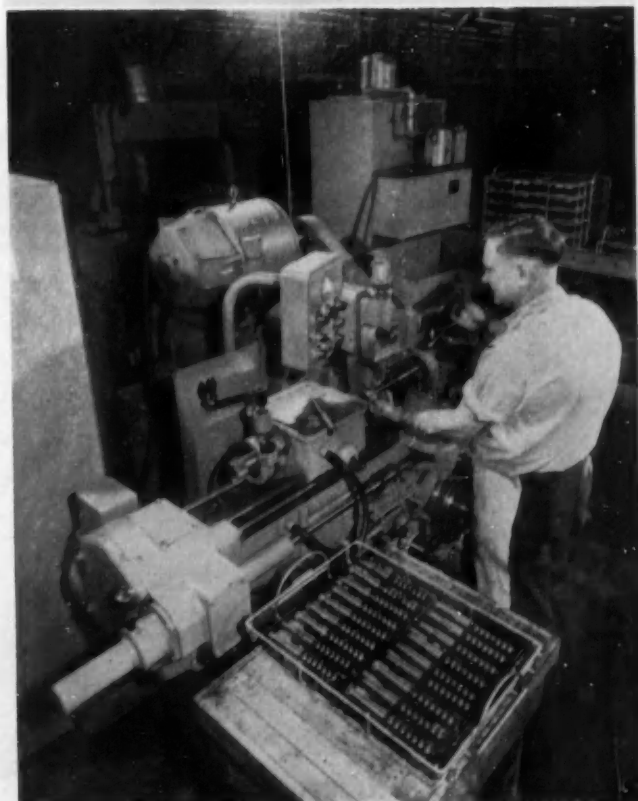
Final major operation is honing of the cylinder bore in a vertical Micromatic honing machine, holding diameter to 3.374-3.376 in., and holding surface finish to a maximum of 15 microinches. All housings then are pressure tested for soundness in water with air pressure of 200 psi.

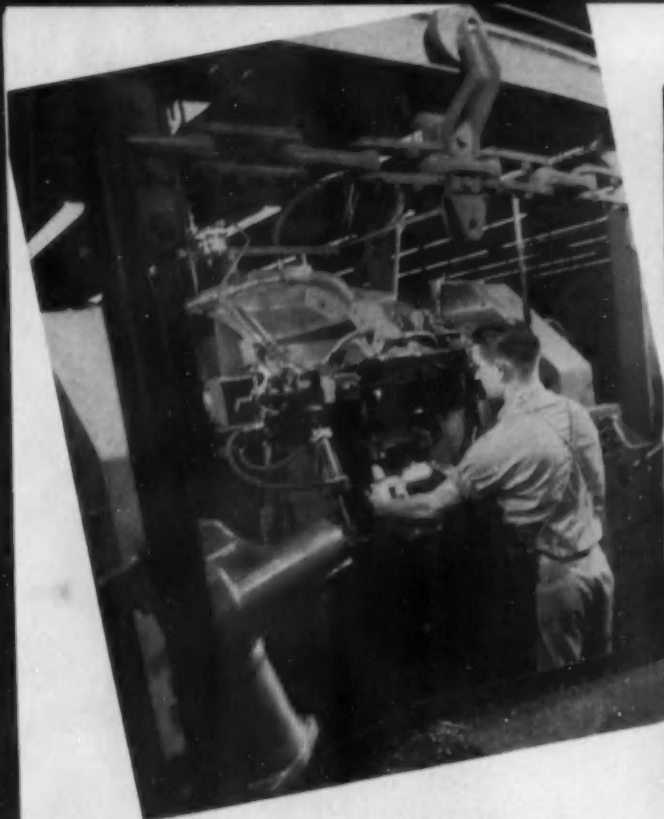
One of the most intricate parts from the standpoint of processing is the connector. Machined from bar stock in 2 $\frac{5}{8}$ -in., eight-spindle Conomatics to provide the formed



Milling the two massive keys in the connector from the solid body is done in this Sundstrand mill. The operation is done dry, with high cutter speed and rapid feed.

Jones & Lamson precision thread grinders are employed for form-grinding the worm for precise fitting with the connector.





Close-up of work station of one of the numerous Buhr special machines on the lower housing machining line. This machine, of trunnion type, takes the lower housing lengthwise, as shown, drills and bores from both ends simultaneously.

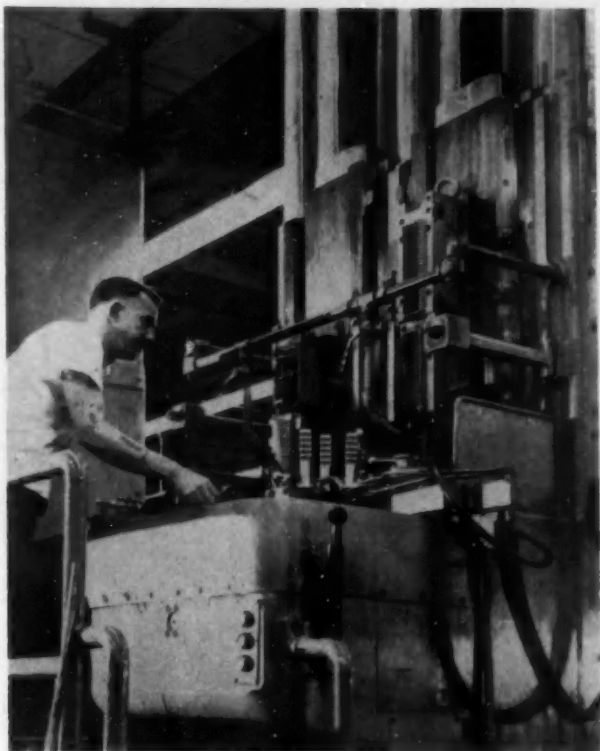
Among the variety of large, vertical broaching machines in the plant is this La Pointe broach for broaching the two large keyways in the upper housing.



Looking down on the work station of the special Ex-Cell-O four-way precision-boring machine for boring the lower housing from four sides.

This Micromatic honing machine is used for honing the bore of the lower housing. It is necessary not only to hold close limits but surface finish must be held to a minimum of 15-microinch.





Rack teeth are broached from the solid in this enormous No. 10/66 Cincinnati Duplex Hydromatic surface broaching machine. The job is handled in two settings—finishing the top surface at the left; then cutting the teeth at the station on the right.

and drilled blank, it is rough- and semi-finish ground on the OD in successive stages in Cincinnati Centerless grinders, holding the diameter in each case to plus or minus 0.001 in. Next comes one of the really unusual steps—milling of two deep keys, one on each side of the part, from the solid bar. This is done in a Sundstrand Rigidmill fitted with an automatically-indexing fixture, indexing 180 deg to present the opposite side after one key has been finished. Secret of the success of this operation is the use of milling cutters of special design, fitted with carbide inserts and cutting dry. Cutters are operated at 750 rpm, with feed of 13.2 in. per minute.

A flat is broached on one end in an American broaching machine; then a series of drilling, forming, chamfering, and tapping operations is performed in an 18-spindle Kreuger-Barnes, eight-station Feedex machine. A noteworthy feature of this machine is the experimental installation of an electric sensing attachment at one station—drilling two extra deep holes—designed to sense the extra pressure in the event of a broken drill. In case of drill breakage the sensing device will stop the machine.

Following washing and copper plating, the connector is presented to an Ex-Cell-O Scrub-Broach in which the helical ball race groove is generated from the solid bore with a special broaching tool. The work then is washed, heat-treated, rereamed, recentered, finish-ground on the OD in a Norton 10 by 18 grinder, and the two keys semi-finish- and finish-ground successively in 6 by 18 Norton surface

grinders. In the latter operation width is held to 0.2495-0.2515 in., maintaining a tolerance of 0.0015 in. from the center, holding the length of flat to plus or minus 0.005 in.

Two bores in the connector are finish-ground in a double-index cycle in a No. 271 Heald Size-matic internal grinder. The ball race then is finish-ground in a special Ex-Cell-O thread grinder; while the external thread is ground from the solid in a Jones & Lamson thread grinder.

After inspection both the worm and connector are color coded to provide for selective fitting of mating parts within 0.0005 in. Control of maximum clearance is imperative to provide for proper fitting of the precision bearing balls.

The piston or valve body of the unit is of cast iron, machined in two operations in New Britain Model 675, six-spindle, automatic chucking machines—one taking one side, the other the opposite side. The operations are quite similar—1st operation: turning OD, facing, core drilling, boring, reaming, recessing and chamfering; 2nd operation: turn OD, facing, forming grooves, recessing, core drilling, boring, reaming, chamfering. A distinctive feature of these machines is the development of special tooling for producing recesses for O-rings, held to tolerances previously considered possible only in a precision-boring machine but done at a much higher rate.

Pistons then are ground on the OD in Cincinnati Centerless grinders; finish-bored, grooved, and chamfered in Heald, double-end, two-station Bore-Matics; drilled, milled, reamed in a special horizontal machine; and internally ground to 2.000-2.001 in. in a Heald Gage-Matic centerless internal grinder.

Following this, the piston is assembled with the set of five rings to produce the valve assem-

One of the earliest production installations of Wagner plating equipment is the copper plating unit seen here.



bly. For this operation the piston is heated in an adjacent furnace to 457-500 F, then placed in a six-ton American press to press-in the previously prepared assembly of five rings. As an assembly the part is precision-bored in a Heald double-end Bore-Matic, then ground in a Heald internal centerless grinder, and after washing honed to 1.0000-1.0003 in. in a Micromatic honing machine.

Incidentally, the spool valve, later fitted to the valve body, is ground in a Cincinnati Centerless grinder, then finished in a Cincinnati Centerless Lapper to limits of 0.9997-0.9999 in. with surface finish better than 10 microinches. Spools are selectively fitted in the body at assembly with maximum variation of 0.0006 in.

It is also noteworthy that rings and spacers for the piston are lapped on their faces so that thickness variation does not exceed plus or minus 0.0002 in.

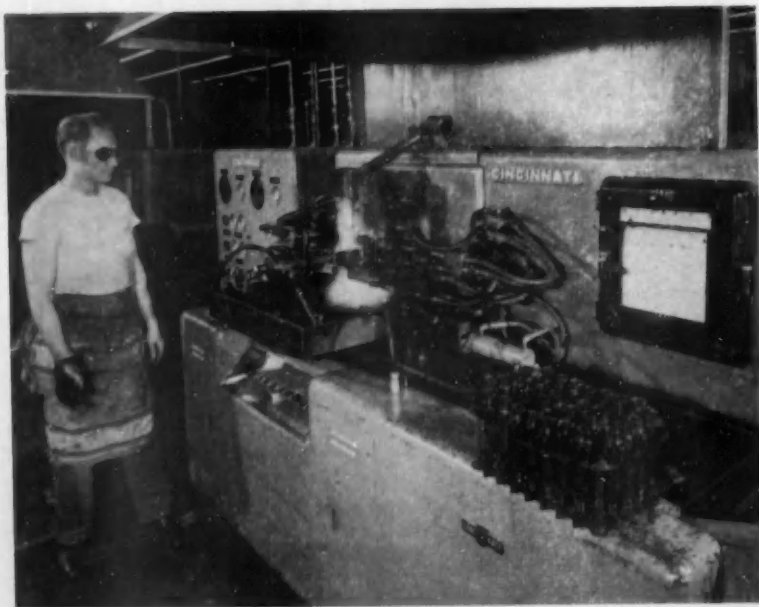
The rack involves some extremely fussy operations to provide for accurate mating with the sector. It comes in as a steel forging, is faced and centered at both ends in a Sundstrand double-end milling and centering machine; rough- and finish-turned on the stem end in successive settings in Sundstrand Stub lathes. Finish machining—turning and facing the flange, drilling and reaming, chamfering and recessing, undercutting and centering—is done in a six-spindle 1½ Cone chucking machine.

Rack teeth are produced by broaching in two operations in a No. 10/66 Cincinnati Duplex Hydromatic broach. Work is loaded in the fixture on the left hand for broaching to produce the top surface of the teeth, then loaded into the right hand fixture where the teeth are cut at an angle of 70 deg, 30 sec to the top face. The part then is washed, carburized, hardened and drawn, and shot-blasted in a Pangborn cabinet.

Centers now are lapped in an Ex-Cell-O lapper, the stem semi-finish ground and adjacent face of flange finish-ground in a Norton 30-deg grinder. Stem diameter next is finish-ground in a Norton grinder; and the



This is the Ex-Cell-O precision thread grinder, set up for form-grinding the internal ball race in the connector.



One of several large Cincinnati Flamatic hardening machines in the heat treating department. This one is set up for hardening gear sector teeth.

larger diameters as well as the adjacent face finish-ground in another Norton 30-deg grinder.

Broaching of rack teeth is taken so seriously, because of the precise mating required with the sector, that special measures were taken in the design of the broach. It is made up of four individual sections, each one taking a specific tooth. Each section, in turn, is

(Turn to page 92, please)

Studebaker's New Models *with Higher Horsepower*

STUDEBAKER-PACKARD CORP. has announced the development of a new Advanced Series to round out the 1955 passenger car offerings of the company's Studebaker Division. President models in the new series will have V-8 engines with 185 hp and Commander models will feature new engines with 162 hp. These power plants will be standard in all other models in the President and Commander lines. Piston displacement of the engines is 259.2 cu in. Compression ratio is 7.5 to 1 with 8 to 1 optional.

Air conditioning and two new power assist options also are being introduced by Studebaker.

The Advanced Series, to be known as Ultra Vista models, will be available in sedans and station wagons, featuring wrap-around windshields with 20 per cent greater glass area.

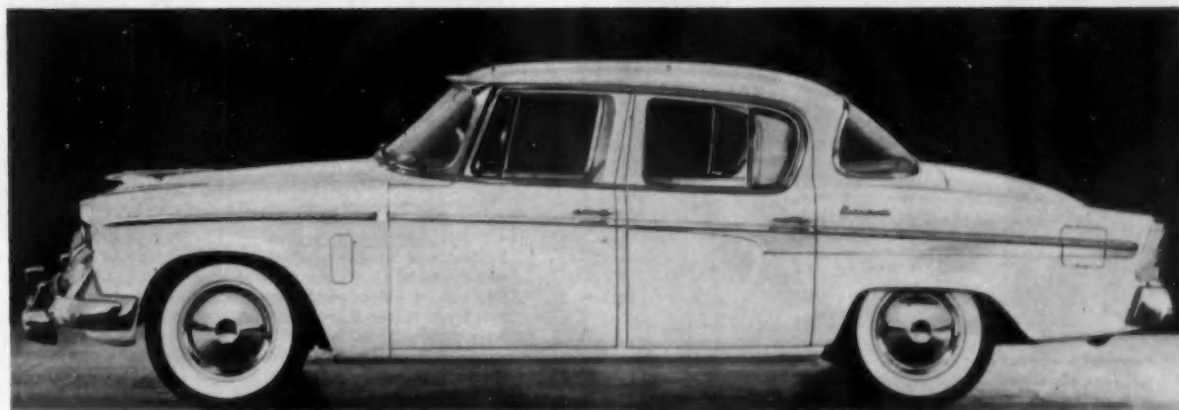
The new windshield design complements the stream-

lined styling of sedans in the Champion, Commander and President series. Hardtop convertibles, five-passenger sports coupes, and the special built "Speedster" retain their contours and long, low silhouette with their original wide-angle-vision windshields.

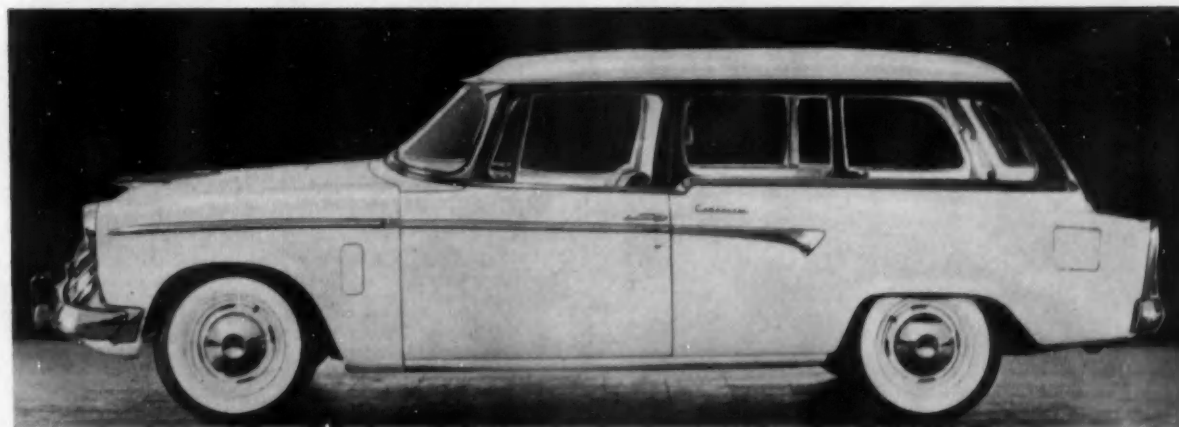
The new model windshields contain 1105 sq in. of glass, an increase of 187 sq in. The models also have a newly designed instrument panel which conforms to the wrap-around windshield and features push-pull switches.

Air conditioning is offered as a new extra cost option on Commander and President sedans. Power window lifts and two-way power seat controls are available on the full line as options at extra cost, along with power brakes and power steering.

Kits available for installation as an accessory on the 162-hp engine provide approximately 20 additional hp.



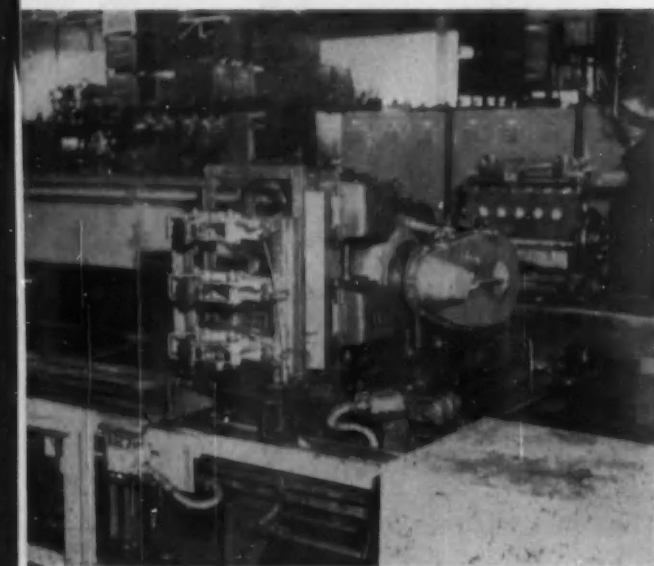
Studebaker President State Sedan, one of the new Ultra Vista models



The 1955 Studebaker Commander Regal station wagon

MOTOR DRIVEN

By David Scott



ONE unusual feature of the engine line at General Motors' Vauxhall plant in Luton, England, is the "motoring" setup for turning over and flushing car and truck engines while assembly and final adjustments are being completed. Each engine is driven for 18 min at 450 rpm by an individual 5 hp electric motor which is carried along the assembly conveyor by the engine pallet.

At the end of this 100-ft section of the line, motors are automatically decoupled from the engines and returned by fast conveyor to the head of the loop circuit. Eighteen motor units are used, including the two that are always joining and leaving the line.

Principal objective of this installation is the

TOP—

Latter half of the motoring section viewed from the power control platform over the center of the line. Engines on the assembly conveyor, coupled to electric drive units, are moving away towards completion. Bus bars feeding the motors run along the center. One drive unit on its trolley is being brought back along the fast return rails by an endless chain. Oil draining from the engines is guttered under the tracks to a central collecting pipe for subsequent re-use.

MIDDLE—

As the returning drive unit approaches the end of the rails, it trips a series of switches which first slow, then stop, the propelling chain. It then coasts onto the final cross-traversing section of track. On the assembly line, work done on the driven engines includes tappet adjustment and ignition timing. On ckd engines for overseas assembly plants, a measured amount of lanolizing oil is injected into the intake manifold. (Guard rails have been removed.)

BOTTOM—

Electric driving unit and trolley at rest on the shuttling rig. Cross travel is synchronized with the movement of the assembly conveyor by a switch tripped by each pallet. The horizontal limit switch shown acts as an interlock to prevent this movement if the trolley is not properly located. The three brushes supplying the electric motor will wipe the bus bars paralleling the conveyor.

ENGINES

on the Assembly Line

internal washing of engines which have been built in an open shop adjacent to machining areas. During the running period, oil is externally pumped into and circulated through each engine at the rate of 2.6 gpm. At the same time, engines receive a preliminary bedding-in under carefully controlled conditions.

The accompanying illustrations show details of the cycle on the Velox and Wyvern lines, where output is 380 engines per day.

TOP—

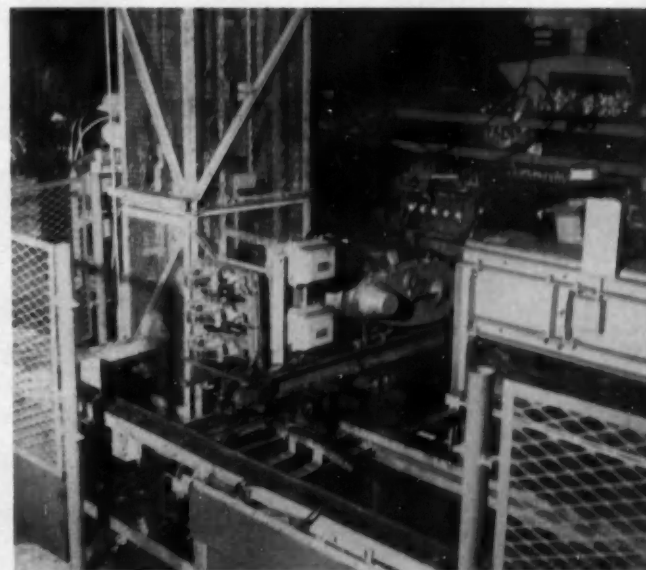
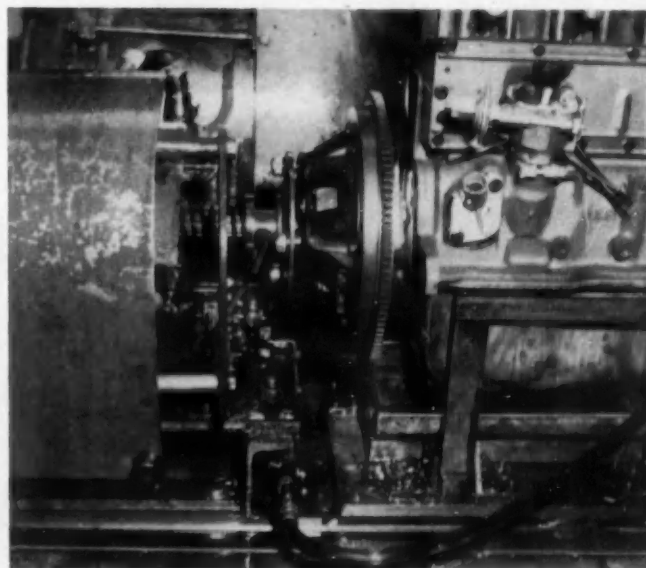
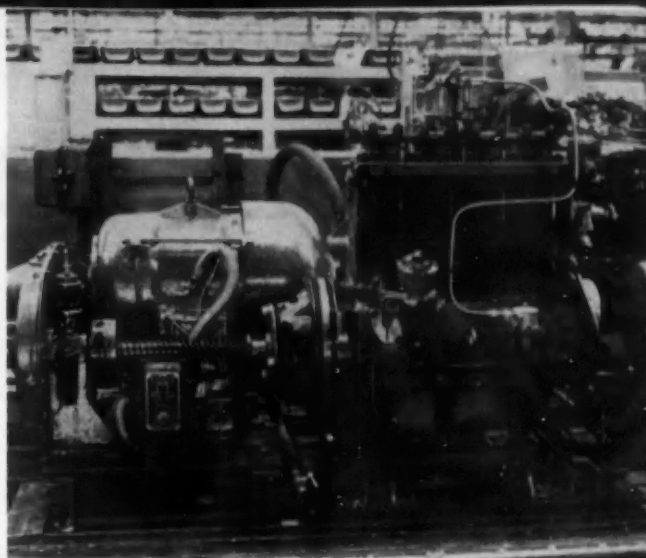
The forward-moving carrier frame of the driving unit is positively located on the assembly conveyor by two strips on each pallet. The shuttling rig remains in the forward position until the trolley is fully on the 100-ft front rails. The spring-loaded splined drive-shaft (safety cover removed) is automatically extended to couple with the engine clutch. The operator will then connect a hose from the individual oil pump, driven by the electric motor, to a blanking plate covering the oil filter mounting facing on the back of the engine block. The driving motor is started manually by push-button, and the pump picks up oil through a hose trailing in a trough beneath the rails.

MIDDLE

Close-up showing details of coupling. The three dowels on the circular plate on the driving shaft engage spring holes in the clutch cover. Outward movement of the splined shaft is effected by a release arm which is automatically tripped at the start of the motoring section. Clean oil heated to 180 F is pumped into the engine. Plug in the oil pan is left out, and oil drains continuously back to the main reservoir. Equipment for filtering, heating and pumping oil for the entire system is on the floor below. Spark plug holes are normally closed by threaded dummies to maintain compression during the running period.

BOTTOM—

At the end of the motoring section the electric motor is stopped and automatically decoupled from the engine. When positioned on the tracks of the shuttling rig, the driving unit (shown here in transit) is withdrawn to line up with the fast return tracks. Vertical caging at the left encloses the counterweight connected by cable to the shuttling conveyor. Appropriate limit and trip switches, operated by the driving unit in its travel, start and speed up the propelling chain, and return the shuttling rig to receive the next unit. (Guard rail removed.)



at PACKARD—a New Setup for

SUPPLEMENTING the several previous articles dealing with the Packard V-8 engine plant in Utica, Mich., this one covers the highlights of piston and connecting rod production.

The aluminum alloy pistons are received in rough-turned state from the vendors to provide for location in first operation equipment. First major operation is the rough-turning of ring lands and facing the dome in eight-spindle, National Acme-Gridley automatics. This is followed by rough- and semi-finish-boring of piston pin holes; chamfering and finish-grooving the pin holes; spot-facing; and rough- and finish-boring and facing of weight bosses, in a four-station, six-spindle Hartford Special trunnion-type machine.

A Modern, eight-spindle drilling machine drills the eight smoke holes in the No. 3 ring groove. The eight heads are arranged radially about the central fixture, the plane of the drill heads being inclined to the horizontal to facilitate loading and unloading.

Sundstrand 8A x 24 in. automatic stub lathes handle the finish-turning of ring lands and skirt; finish-facing and chamfering of the dome; and rough- and finish-turning of ring grooves. A noteworthy feature of these machines is the application of automatic loading and unloading of work. This is done by the action of a single arm, unloading and delivering the machined piston to an out-going chute, then picking a rough piston from the loading magazine chute and loading it into the machine.

Norton 6-in. piston grinders, fitted with Hautau automation for loading and unloading, finish-grind the elliptical skirt, holding maximum diameter to a total limit of 0.00200 in.

Pistons are washed and dried, then proceed to a

group of Morris fully automatic, transfer-type balancing machines for milling the weight bosses to proper weight. It may be noted that Packard practice is to make all pistons to the same weight in the interest of interchangeability in field service.

Final operation is the finish-boring of piston pin holes to a total limit of 0.0004 in. in Ex-Cell-O single-end precision-boring machines.

Pistons then are washed, dried, and tin-plated. Although gaging is done at all individual stations to assure the accuracy of work in process, the last operation on the smaller diameter pistons is the automatic inspection and grading in a special Pratt & Whitney gaging machine. It checks simultaneously—ring groove width, location of rings, parallelism of pin hole, and skirt taper. In addition, it checks the piston pin bore; and grades piston diameter in a range of nine sizes, varying in steps of 0.00025 in. Over- and under-sizes are automatically rejected.

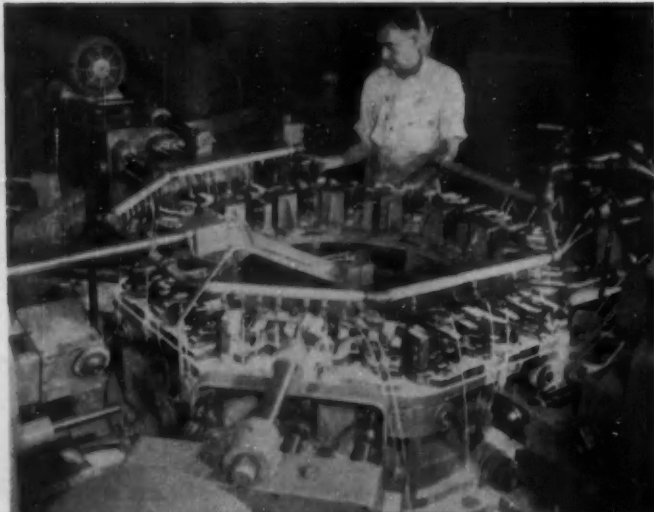
After gaging and grading, the pistons are sorted into suitable bins and held for assembly with rods.

It is of interest that piston storage meet connecting rod assemblies at this point, making it a simple matter to match pistons and rods in accordance with the instructions from the cylinder block department. In effect, as the cylinder bores are graded at one end of the machine shop, the bore sizes for each specific block or engine are transmitted to this area and sets of corresponding pistons are assembled to the rods and delivered by conveyor to engine assembly.

At the present time Packard is producing two sizes of pistons, machining them along parallel lines of equipment. The larger—4 in.—pistons are inspected and graded with a Sheffield gage.

Large Footburt continuous surface broaching machine which is used for broaching the parting faces of connecting rods and caps.

Special Michigan Lever-station machine, handling connecting rods and caps—drilling, reaming, milling, etc., in a continuous cycle.



Machining Pistons and Connecting Rods

Connecting rods are produced to uniform weight, as in the case of pistons, to facilitate field service as well as to maintain engine balance. At Packard, they are handled in two stages—first, starting with the rough forging with cap integral, then completing a series of operations on the rod and cap assembly.

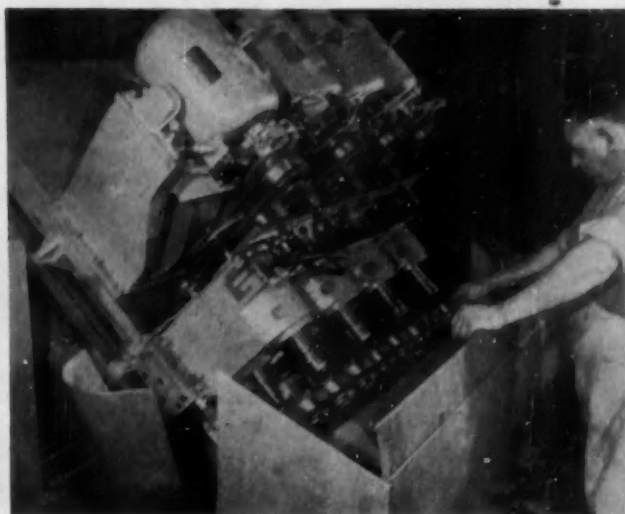
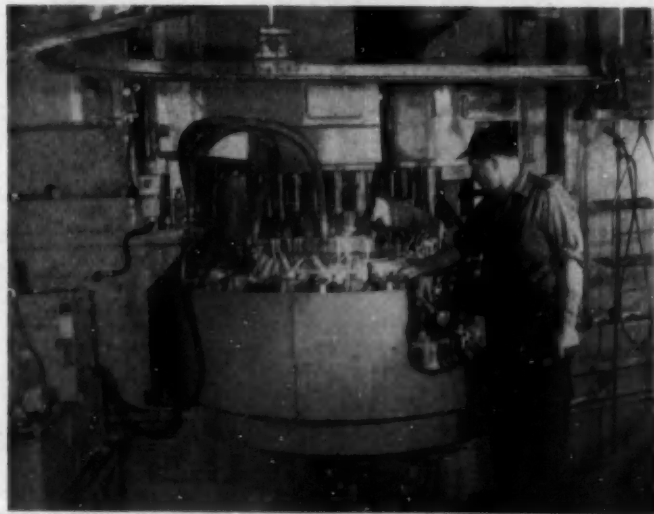
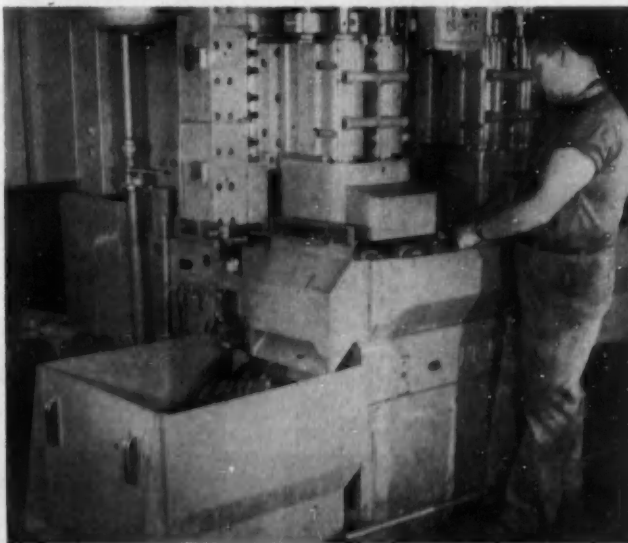
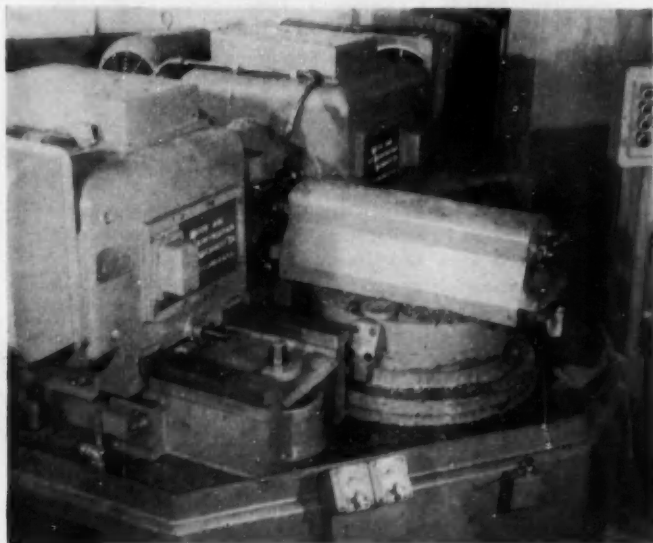
Starting with the rough forging, both faces are ground in Blanchard surface grinders; then the pin holes are bored in a big W. F. & John Barnes multiple-head drilling machine. A Detroit Broach, vertical surface broaching machine of twin ram design, does the broaching of the top and bottom faces and sides

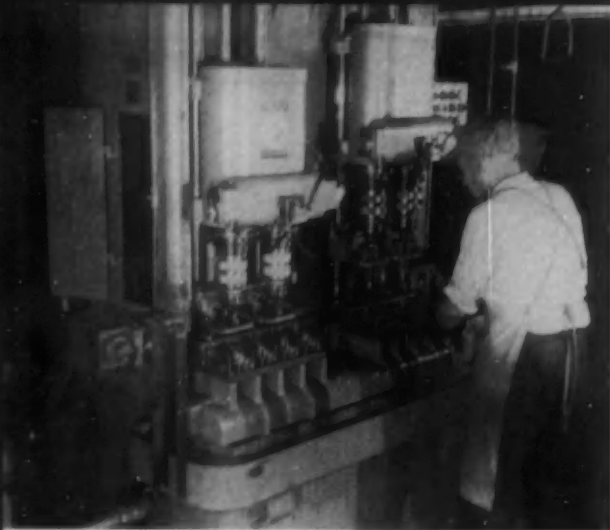
Top left—One of a group of Metch & Merryweather automatic milling machines for milling connecting rod assemblies to exact weight.

Top right—First example of a vertical precision-boring machine made by New Britain. It has two, four-spindle boring heads, bores both ends of four rods at a time.

Bottom left—Large, special W. F. & John Barnes multiple head machine with indexing table for drilling piston pin holes in the rods.

Bottom right—Kreuger-Barnes special machine, of four-station type, with two spindles for each station. It finish-bores piston pin hole; semi-finish-bores big end, chamfers one side.





of bolt bosses; and cuts off the cap.

The rod and cap then go to a large Footburt continuous surface broaching machine, illustrated here, to finish the parting face of both parts.

A seven-station Michigan drilling machine handles the drilling and reaming, etc., of bolt holes in rods and caps.

Rods and caps now are brought together in pairs, the bolts pressed into place in the rod, then the fastenings completed with a torque wrench. Before proceeding with the final stages of machining, the rod and cap assemblies go to another Blanchard surface grinder for finish-grinding of both sides of the crank and pin bosses.

Piston pin bores are finish-bored to 1.0345-1.0355 in.; the crankpin bore is semi-finish-bored to 2.370-2.372 in.; and one side chamfered, in a single setting in a special four-station Kreuger-Barnes horizontal boring machine, illustrated here.

A five-station, Modern special machine is employed for pressing-in the bushing, burnishing to 0.9682-0.9692 in., chamfering both sides and drilling.

The assembly is presented to a group of Motch & Merryweather weight milling machines, designed to mill the weight bosses on both ends to produce a standard weight with proper distribution of weight at each end.

One of the distinctive pieces of equipment on this line is the special New Britain vertical precision boring machine for boring both ends of the rod. Possibly the first machine of this type installed in the Detroit area, it has two, four-spindle heads, bores both ends simultaneously in four rods.

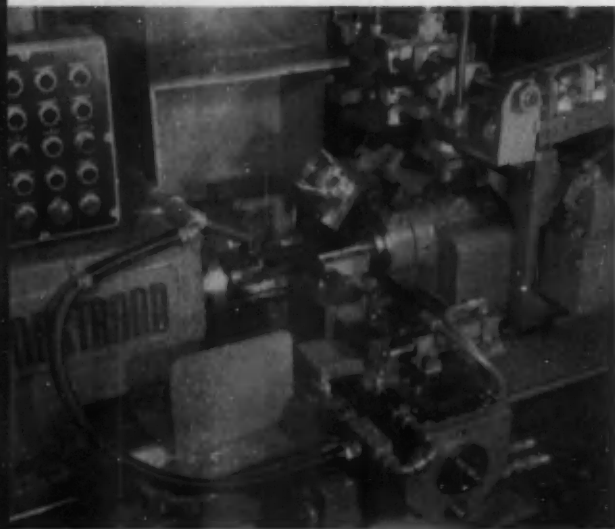
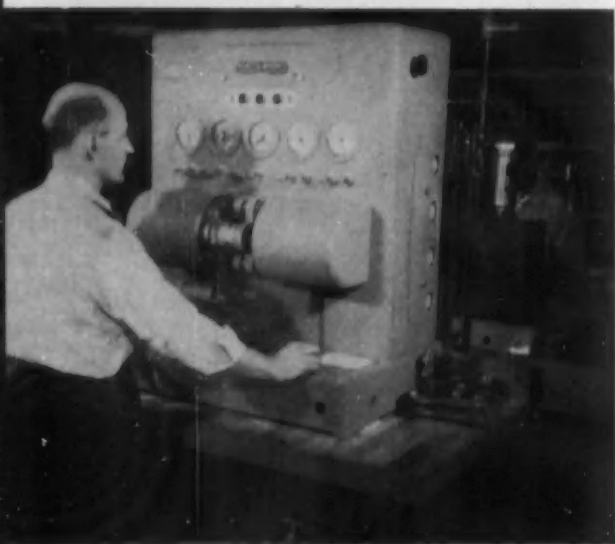
Following some detail operations, the crankpin bore is finish-honed in a Micromatic Microsize honing machine fitted with two, two-spindle heads.

At the completion of the machining stages the rods reach the final inspection stage where they are checked 100 per cent in a special Pratt & Whitney gaging machine. Simultaneous checks are made of crank bore size, twist, parallelism of both ends, and pin hole grading. Then the rods are checked for weight on Toledo scales, sorted according to pin hole size, and placed in the storage bins, ready for assembly with pistons.

Top—Big ends of connecting rods are finish-honed in this Micromatic Microsize honing machine. As illustrated, it has two, two-spindle stations, hones two rods at a time. Each fixture holds four pairs of rods as shown.

Middle—Pratt & Whitney Air-O-Limit, electronic inspection machine on connecting rods. It makes simultaneous checks on crank bore size, twist and parallelism of both ends, and grades the pin bores.

Bottom—Sundstrand automatic stub lathes are set up for finish-turning of pistons. A distinctive feature of these machines is a unique form of automation, seen in operation here, for loading and unloading—taking work from the magazine and returning it to the outgoing conveyor chute.



ALL-PLASTIC Construction

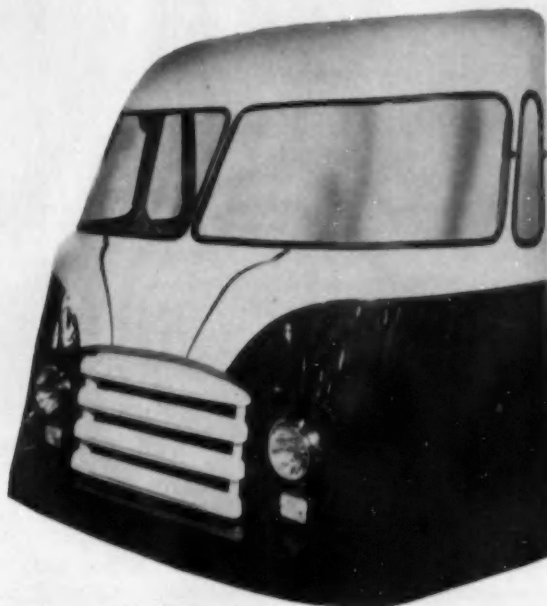
Economical for Truck Cab

IN recent months there has been a great deal of emphasis on the utilization of reinforced plastics for truck cabs, bodies, and miscellaneous cab and body parts. The polyester-glass combine is said to be particularly advantageous for the short-run production requirement which is usually a major factor in the specialty truck field. Plastics engineers have borne this out with various cost studies which show that economical production can be achieved with the laminated material when working in terms of under 15,000 production units.

A mid-west molder and fabricator, Regal Plastic Co., Kansas City, Mo., working in conjunction with a custom truck producer, General Body Mfg. Co., of Kansas City, developed an all-plastic cab. This joint effort was brought about because of a problem in manufacturing a streamlined truck cab from sheet metal. Tooling costs for dies would have been prohibitive for the number of units involved, so for some time the cab parts were made by drop hammer and hand shaping. When the parts were joined by welding, assembly required many hours of finishing time.

Thus, due to the configuration and its associated manufacturing problems for the limited production quantity, plastics are the basic structural material for the cab. The product is made in one piece with all of the reinforcements molded in.

Low pressure bag molding of the type so common to the reinforced plastics industry is utilized to produce the unit. In this particular instance, the actual cost of the complete polyester-glass part is very



All-plastic truck cab developed by Regal Plastics and General Body.

comparable to that involved in the original sheet stock assembly. However, an additional amount of streamlining has been incorporated in the design, and the pigment is an integral part of the molding.

Because of the acceptance of the laminated plastic cab, Regal and General Body are currently working on all-reinforced plastic bodies for Chevrolet truck chassis. General Body now has door-to-door delivery trucks of three basic materials in production—steel, aluminum, and glass fiber polyester.



Complete truck bodies are currently being made entirely of reinforced plastics by General Body. This particular unit, called the Han-D-Van, has a GVW of 5500 lb.

Continuous Plating of Bumpers

A COMPLETELY modern and unique plating setup is currently being employed by Pontiac for passenger car bumpers on an extremely high output basis. Only one machine, a Udy-lite automatic selective cell unit, is utilized for the continuously automatic plating cycle.

The machine which is approximately 480 ft long and 62 ft wide overall, operates on a two minute cycle to plate 30 racks of 12 bumpers every hour. At the loading end of the plating unit, there is a rack storage area of 9300 sq ft. After the plain steel bumpers are hung on the racks, a Cleveland Tramrail hoist picks up the work carrier or rack and starts the dozen bumpers through the plating cycle.

For the initial operation, the Tramrail lowers the rack in the soak clean tank and then deposits the carrier on the transfer mechanism within the tank proper. This method of handling permits the parts to remain at rest in the so-called nest of conforming anodes in the cells of the plating tank for the required plating time. Empty cells are selected in sequence to accommodate racks as they emerge from a preceding operation. Cathode contacts are elevated above the tanks to permit the work to be connected to the source of current before entering the solution. Speed of the machine is based on the control settings of the Vickers hydraulic drive units. Most of the tanks are Koroseal lined.

The series of operations, which also corresponds to the numbered stations shown on the accompanying drawing, are as follows:

1. Load and soak clean—three station tank, rack moves in down position through the 1st cell—2½ min.
2. Soak clean—two cell tank—2½ min.



Looking toward the loading end of the automatic plating machine from the 18th station, the work carrier is shown immersed in the acid copper bath. Note the pre-contact slides in background.

3. Warm water power spray—one cell, empty tank, constant spray—1¼ min.

4. Power wash—three-cell empty tank, storage tank outside, 12 ft by 7 ft by 7 ft with six pumps, three in and three out, also one standby—3¾ min.

5. Cathodic clean—three cells, using 10,000 amp at nine volts—3¾ min.

6. Cold water rinse—one cell continuous circulation—1¼ min.

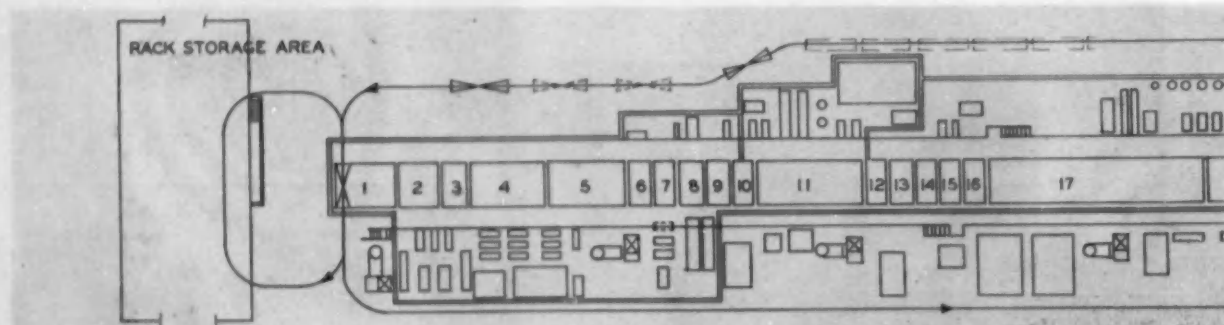
7. Drain and transfer—one cell space—¾ min.

8. Acid dip—one cell tank, continuous circulation using 20 gpm Durichlor pump—1¼ min.

9. Cold water rinse—one cell tank—1¼ min.

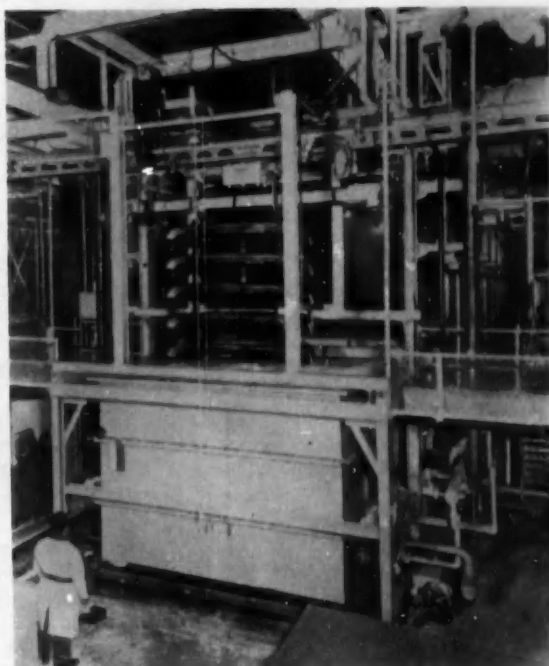
10. Cyanide dip—one cell tank—1¼ min.

11. Cyanide copper strike—four cell tank—5 min.

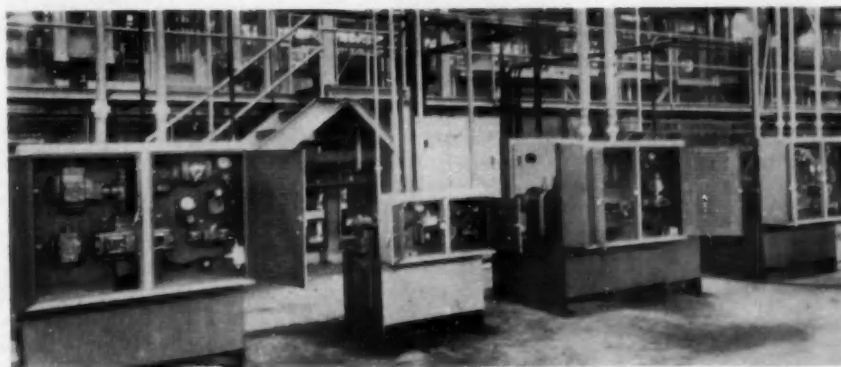


in Huge Automatic Machine

12. Recovery rinse—one cell—1¼ min.
 13. Cold water rinse—one cell, continuous circulation—1¼ min.
 14. Cold water rinse—one cell, continuous circulation—1¼ min.
 15. Acid dip—one cell tank, continuous circulation using 20 gpm Durichlor Pump—1¼ min.
 16. Drain and transfer—one cell space—½ min.
 17. Acid copper—two eight cell tanks, 24,000 gal each and 50 ft long each—air agitation, continuous circulation through heat exchangers—using 60,000 amp at six volts—0-30 min. per tank.
 18. Drain and transfer—one cell space—½ min.
 19. Recovery rinse one cell tank—continuous circulation—1¼ min.
 20. Cold water rinse—one cell tank, continuous circulation—1¼ min.
 21. Cold water rinse—one cell tank, continuous circulation—1¼ min.
- (Turn to page 106, please)

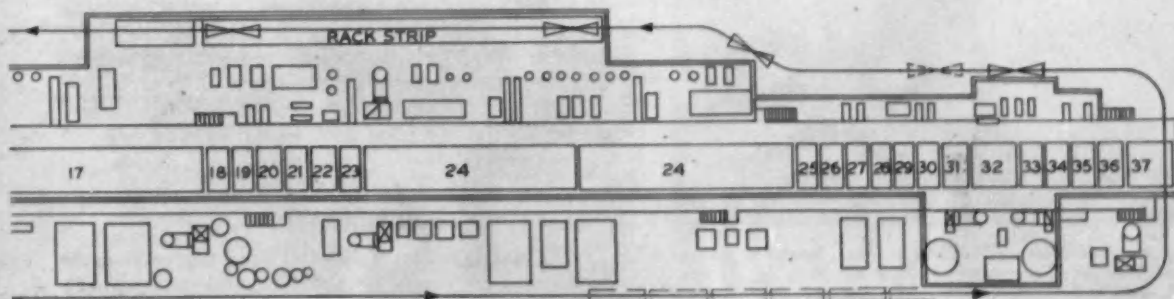


Loading end of the automatic machine with the Cleveland Tramrail in the up position prior to lowering bumpers in the soak clean tank.



Some of the Vickers hydraulic power drive units used in the Pontiac installation. Three control valves in each cabinet regulate speed of the machine.

Below is shown layout of the Udyllite automatic plating machine recently installed by Pontiac for passenger car bumpers.



By Paul Kennedy

SAE Holds First Golden

FIRST of 11 SAE Golden Anniversary meetings scheduled for 1955, the Annual Meeting of the Society of Automotive Engineers visualized the future while paying tribute to past progress. Detroit again was host last month to engineers and executives who gathered to hear 59 papers and panel discussions.

Incoming president C. G. A. Rosen was introduced at the annual banquet. He is consulting engineer to the president of Caterpillar Tractor Co. The first plaque honoring SAE Pioneer Members was presented to P. M. Heldt, Engineering Editor Emeritus of AUTOMOTIVE INDUSTRIES. His editorial in the predecessor "Horseless Age" in 1902 called for the founding of such a society, and sparked the beginning of SAE. The "SAE Golden Anniversary March" was played for the first time by Macy O. Teeter, SAE member and composer.

Speaking on "The Next Fifty Years" was C. F. Kettering, director of General Motors Corp. In his

inimitable style he reviewed automotive progress of the past 50 years to explain "how perfectly silly it is to try to predict the future." He observed that the horsepower race really began about 1905. Concerning thermodynamics, he said the only thing he has learned was that combustion was too fast if it burned the metal, and that "the Second law is: You can't push on something that's going faster than you are."

Greater space was required to house the large number of exhibits this year. In addition to many automotive components of long standing, new developments and experimental devices of various kinds were displayed. It is possible to give only a sample of the range of new items shown. Leece-Neville displayed its new a-c electrical system for cars and trucks (see AUTOMOTIVE INDUSTRIES, Nov. 1, 1953 and Jan. 1, 1955 issues). Kysor Heater Co. showed a prototype package air conditioner for mounting on the roof of a truck cab, featuring a self-contained power plant. Spicer Div. of Dana Corp. had its new Synchro-Verter transmission, a two-stage torque converter and five-speed gearbox manually shifted, with finger-tip control of the clutch. The converter can be locked out giving in effect 10 speeds. American Bosch Div. of American Bosch Arma Corp. showed the new Diesel injection system which was the subject of a paper (see below). Continental Motors Corp. displayed its new 240-hp V-8 engine (see AI, Jan. 1, 1955). Taylor Dynamometer & Machine Co. featured its Hi-Eff hydraulic dynamometer line just introduced. Brush Electronics Co. had at its stand digital instruments for automatic counting, recording and control. Rosan Inc. featured self-tapping thread inserts. The prototype of an electronic engine analyzer was shown by the Allen B. Du Mont Laboratories. Forged aluminum wheels used on the Cadillac Eldorado were shown by Kelsey-Hayes Wheel Co. and Aluminum Co. of America. At a press conference, Purolator Products, Inc., introduced a line of dry-type air filters for gasoline and Diesel engines. Pierce Governor Co. introduced the series 300 engine governor, featuring three interchangeable weight mechanisms for various degrees of accuracy. Wayne Engineering Research Institute showed a development for machining irregular curves directly from a drawing.

A roundup summary of many of the papers presented at the meeting is followed by abstracts of selected papers.

... AIRCRAFT ...

Long and short term forecasts for future aircraft emphasized the engine problem. Several sessions were devoted to jet fuels, powerplants, and design of trans-



P. M. Heldt is showing the SAE Pioneer Members plaque he received at the annual meeting banquet, to his son, W. H. Heldt, industrial specialist with the Army Corps of Engineers

Anniversary Meeting

port and military aircraft. Dr. A. L. Klein, of the California Institute of Technology and Douglas Aircraft Co., looked 50 years ahead at commercial flying and saw average flying speeds of 1000 mph, widespread use of helicopter, simpler instruments and controls, and great strides in metallurgy. More specifically, R. P. Buschman of Lockheed Aircraft Corp. called for new criteria in selecting aircraft for certain missions. For commercial transport he proposed "profits of airline per year per dollar invested," and illustrated how direct operating cost alone is not the only basis for selection of a particular airplane. Pointing out that in 10 years about \$1 billion was spent in the U. S. on development of what proved to be unwanted aircraft, he detailed a system for planning for the best military airplanes. He presented a simple systems analysis to show that the criteria should be "least cost for a given effectiveness," or "more bang per buck."

An operator and two builders reviewed the air transport industry and specifically the coming jet



C. G. A. Rosen, newly elected president of SAE for 1955

transport. J. T. Dymont of Trans-Canada Airlines claimed that only experienced commercial builders will sell jet transports to the air lines. Engines will

EXHIBITORS IN ENGINEERING DISPLAY

Aeroquip Corp.
Aluminum Company of America
Aluminum Industries, Inc.
American Bosch Arma Corp.
American Bosch Div.
Anchor Coupling Co., Inc.
Auto Specialties Manufacturing Co.
Automotive & Marine Products Corp.
Automotive Rubber Co., Inc.
Bendix Aviation Corp.
Bohn Aluminum & Brass Corp.
Brush Electronics Co.
The Buda Co.
CEC Instruments, Inc.
Cities Service Petroleum, Inc.
Cleveland Graphite Bronze Co.
Continental Motors Corp.
Cummins Engine Co., Inc.
Dana Corp., Spicer Manufacturing Div.
The Danielson Manufacturing Co.
Detroit Aluminum & Brass Corp.
Detroit Controls Corp.
The Dow Chemical Co.
Allen B. DuMont Laboratories
Duoloc Drive, Inc.
E. I. Du Pont de Nemours & Co.
Rubber Chemical Div.

Engineering Castings, Inc.
Fram Corp.
Garlock Packing Co.
Gemmer Manufacturing Co.
Groov-Pin Corp.
Haskelite Manufacturing Co.
Heli-Coil Corp.
Hercules Motors Corp.
Hughes Aircraft Co.
International Research & Development Corp.
Johnson Bronze Co.
Kelsey-Hayes Wheel Co.
Kolene Corp.
Koppers Co., Inc.
Kysor Heater Co.
Le Roi Co.
Leece-Neville Co.
G. H. Leland, Inc.
Lincoln Engineering Co.
Link Engineering Co.
Lisle Corp.
Lord Manufacturing Co.
The MB Manufacturing Co., Inc.
McCulloch Motors Corp.
Metals & Controls Corp.
General Plate Div.

Metals & Controls Corp.
Spencer Thermostat Div.
Meridan Corp., Flex-O-Tube Div.
Mitchell & Smith
Monroe Auto Equipment Co.
Perfection Stove Co.
Performance Measurements Co.
The Pierce Governor Co.
Robertshaw-Fulton Controls Co.,
Fulton Siphon Div.
Ross Gear & Tool Co.
Schwitzer-Cummins Co.
Sonotone Corp.
The Sparks-Withington Co.,
Sparton Automotive Div.
Stewart-Warner Corp.
Taylor Dynamometer & Machine Co.
Titeflex, Inc.
Torrington Manufacturing Co.
Vickers Inc.
Victor Manufacturing & Gasket Co.
Waldes-Kohinoor, Inc.
Wallace & Tiernan, Inc.
Waukesha Motor Co.
Wayne Engineering Research Institute
Webster Electric Co., Oil
Hydraulics, Inc.
Zollner Machine Works

be turbo-props for medium and long distance routes by 1960, with the possibility of turbo-jets for long hauls if the air lines can agree on a particular design. He added the plea that builders reduce landing speeds and simplify the cockpit.

A modification of the present Air Transport Association formula for direct costs was shown by examples to give an advantage to the future jet transport. G. S. Schairer of Boeing Airplane Co. said that a 50 to 100 per cent increase in speed required such a review of the basic cost formula, and he examined many of the points to be considered.

Potential cargo volume in the 1960's could be nearly four billion ton miles per year instead of the current $\frac{1}{3}$ billion, if the rate went down to nine cents per ton/mile from 30 cents at present. Cutting rates in half would multiply the volume ten times, according to Carlos Wood of Douglas Aircraft Co. He traced the developments here and abroad in engines and airframes suitable for various route lengths.

... COST REDUCTION ...

The Atlantic City Motor Truck Co.'s cost reduction committee met again. This group, under the name of a non-existent company, first met at the 1954 Summer meeting. Consensus was that variable costs are the key to savings in a small firm which buys major components for assembly. Goal was to double production after a bad sales year. Various aspects of manufacturing expense were explored. A make-or-buy program was instituted to look at the few high-dollar items out of some 5000 purchased parts. Automation and modernization in such a small plant should be based on overall departments, rather than on individual machines or production items. The panel pulled no punches in highlighting the conflicts between departments, causing many a wry smile. Led by C. L. Hecker of Oliver Corp., the panel included J. E. Adams, White Motor Co.; R. E. Cross, Cross Co.; L. E. Commings, Delco Products Div.; J. F. Jones, Hudson Motor Car Div.; M. F. Macauley, Steudaker-Packard Corp.; T. H. Morrell, Oliver Corp.; H. A. Williams, Eaton Mfg. Co.; and F. J. Zielsdorf, Oliver Corp.

Advantages of automation, stated W. C. Newberg of Dodge Div. of Chrysler Corp., often are measured in terms other than direct savings in dollars. Examples in his paper included savings in floor space, greater safety, improved quality, and greater production rates, as well as more efficient use of manpower. In fact, he said, the overall effect of automation probably will be to increase total employment.

Similar experiences at Ford Motor Co. were related by G. G. Murie. He was frank to list some disadvantages of automation, and to consider how Ford overcomes them.

... ENGINES, FUELS AND OILS ...

A glimpse at a gas turbine regenerator for automotive use was given by A. H. Beaufrere of Ford Motor Co. The heat exchanger Ford is testing is the

SAE Officers for 1955

President

Carl George Arthur Rosen, Caterpillar Tractor Co.

Treasurer

B. B. Bachman, Autocar Div., White Motor Co.

Vice Presidents

Air Transport—R. Dixon Speas, Consultant
Aircraft—James D. Redding, Westinghouse Electric Corp.
Aircraft Powerplant—F. E. Carrol, Jr., United Aircraft Products, Inc.
Body—H. S. Kaiser, Pontiac Motor Div., General Motors Corp.
Diesel Engines—Fred A. Robbins, Koppers Co., Inc.
Engineering Materials—W. Paul Eddy, Jr., Pratt & Whitney Aircraft Div. of United Aircraft Corp.
Fuels and Lubricants—John F. Kunc, Jr., Esso Laboratories
Passenger Car—Robert F. Kohr, Ford Motor Co.
Production—Paul A. Miller, Ford Motor Co.
Tractor and Farm Machinery—Trevor Davidson, Bucyrus-Erie Co.
Transportation and Maintenance—Robert Gardner, American Trucking Association
Truck and Bus—R. C. Norrie, Kenworth Motor Truck Corp.

New Councilors

M. C. Horine, Mack Mfg. Corp.; M. P. Jolley, Canadian Acme Screw & Gear, Ltd.; and W. G. Nostrand, Winslow Engineering Co.

matrix type which rotates slowly between compressed intake air and exhaust. He said the sealing problem is not formidable, but declined to give details. The engine itself is the free turbine type, with the compressor turbine and the driving turbine not connected mechanically. Pressure ratio is four to one, he said.

Diesel engine performance demands will promote turbo-supercharging for both four and two-stroke engines, said C. G. A. Rosen. Efficiencies increase and fuel quality is less of a problem, he added. He reported on some ignition experiments, and said this was a field open to further exploitation.

Detailed descriptions of two new V-8 engines were given in papers by R. F. Saunders of Chevrolet Motor Div., and C. B. Leach and E. L. Windeler of Pontiac Motor Div. (See AUTOMOTIVE INDUSTRIES, Nov. 1, 1954). Both papers illustrated a sharp reduction in the number of cores for casting the blocks and heads. There are no flanges projecting into the center area at the top of the blocks; green sand forms the entire surface. Only external core surface is the rear one. Pasting and nailing are virtually eliminated. Nine major and three minor block cores are used by Chevrolet; only eight for Pontiac. Chevrolet uses 131 lb of sand; 158 for Pontiac.

Turbine power for large tractors and earthmovers of 300 hp and over should be considered well, said C. E. Frudden of Allis Chalmers Mfg. Co. Reduced space requirements could make this type of powerplant attractive, he said. Lack of engine braking is

not a handicap, he explained. On tractors in general, he called for an industry-wide program to standardize on attachment of implements.

Fuels and lubricants problems of current moment were outlined by several speakers. In a tribute to the cooperation which the automotive and petroleum industries have exhibited for so many years, T. A. Boyd of General Motors Corp. traced the progress to the SAE's activities and of the Coordinating Research Council for the past 40 years and more. He listed a number of areas where problems still need to be solved: combustion deposits; lubricating oils for lower octane requirements; gasoline storage; oil stability testing; wear; boundary lubrication; exhaust gas analysis; correlating molecular structure with physical properties; and mechanism of combustion.

Among the specific problems was vapor lock, discussed by D. P. Heath and R. H. Thena of Socony-Vacuum Oil Co. Mr. Heath called for more volatile fuels to save American motorists an estimated \$100 million annually. He said changes should be made in Government and ASTM gasoline specifications, to bring this about. More careful design of fuel systems will be required to overcome vapor lock tendencies with more volatile fuels, he said. The current Reid vapor pressure method of measuring vapor-locking tendencies is inadequate, he added.

Sludge suspension in detergent oils was investigated and reported by R. L. Willis and E. C. Ballard of Du Pont. Laboratory and road tests showed the new nitrogen-containing polymers to be effective at low temperatures; the reason was shown to be insensitivity of this type of detergent to water.

Knock tests based on composition of gasoline and oil were reported in a paper by C. L. Fleming, Jr., N. V. Hakala, L. E. Moody, R. W. Scott and C. O. Tongberg, all of Esso Laboratories. Increased volatility fuels and multi-viscosity lubricants reduce the octane requirements. Compression ratios of 9.5 or 10 to 1 would be feasible on 98-99 Research Octane fuels when fuel and oil have these features, they reported.

Abrasive wear tests on piston rings in engines, using controlled particle size, were reported by C. E. Watson, F. J. Hanly, and R. W. Burchell of the California Research Corp. They used a fast, accurate test method, in which the rings were irradiated and detection equipment was used to eliminate tearing down the engine.

... CARS AND TRUCKS ...

Discussing future passenger cars, several speakers agreed that there is no prospect for abrupt changes in current trends. Maurice Olley, Chevrolet Motor Div., saw no radically smaller cars. Increasing use of accessories such as power devices will counterbalance use of lighter materials, to maintain or possibly reduce slightly the average weight of 3250 lb held since 1935. Expressways will call for cruising gears, and will demand more attention to riding qualities. Mr. Olley questioned the floating ride, and listed boredom as one of the greatest hazards of future driving.

Three types of passenger cars may emerge shortly, said H. E. Chesbrough of Chrysler Corp. He listed the long-distance cruiser, the urbanite general purpose car, and the sports car. For expressway driving a six-passenger cruiser might reach 300 in. overall length. It could have a smaller engine, and feature electronically controlled steering and stopping on suitable highways. Seats would be moveable, and structural glass could allow a transparent roof with an electrostatic method of making it opaque. A four-passenger utility car for shopping would feature smaller size and good acceleration, he said. Sports car predicting he left to the audience.

Commenting on the mechanics of body designing, Mr. Chesbrough called for simpler procedures for getting from the wash drawing to the die model. He proposes a pantagraph-type device for transcribing a clay model to working drawings.

Agreement between engineer and stylist was reached on at least one session, at least in theory. Raymond Loewy took aim at nearly every sacred cow of 1955 automotive styling. If his shots hit home, at least they did so with wit and honesty. Earle MacPherson of Ford Motor Co. explained the kind of attitude that management must develop in creative people. He said some of today's executives allow business to override creativeness; tomorrow's managers who will be dealing with creative people should come from the creative ranks, and top management will have to train them in business disciplines.

Plastic truck bodies received concerted attention. Authors reported on actual experiences in building van delivery bodies, trailers and trailer liners, and tank trailers.

The conservative truck and bus makers will make no radical changes in the near future, according to C. A. Lindblom of International Harvester Co. Economics of mass production may set a limit to the size of components as well as vehicles such as off-highway trucks. In the first case, we may expect more dual powerplants, for instance, when higher power is needed. Major problems now concern transmissions and lubricants, he stated. Quite specifically he outlined concepts of three classes of trucks and buses. For general use, the 1/4-ton pickup truck will gross 2500 lb, have 100 hp, and offer greater part-throttle economy. Styling will more closely approach the passenger car.

For city service, Mr. Lindblom spoke of small high-rpm engines in standing-drive and COE low entrance trucks, some even eight-wheelers with two steering axles for congested area service. Transit buses will emerge as trains, perhaps with their own right-of-way.

Highway hauling on the 25,000 miles of expressways expected in the next 25 years will call for two and three-trailer rigs up to 125 ft long and 160,000 GWV. Off-highway vehicles have about reached their largest economical size, he added.

The opposite view on power plants was taken by Orville A. Brouer of Swift & Co. He predicted gas turbine-powered trucks in the not-too-distant future.

(Continued on next page)

... MATERIALS ...

A new high-temperature alloy for jet engines, GMR-235, is a nickel base alloy reported on by D. K. Hanink, F. J. Webber and A. L. Boegehold of General Motors Research Laboratories. It was said to equal in performance many current alloys containing much higher percentages of strategic materials.

Methods of measuring residual stresses were reviewed in some detail in a paper by J. A. Halgren, T. C. Huang and E. I. Blount of International Harvester Co. Means to control several types of residual stresses were outlined by George Sachs of Syracuse University. He included an extensive bibliography on the subject. O. J. Horger of Timken Roller Bearing Co. discussed means of correlating residual stresses with performance of bearings. Fatigue tests of mild steel members of various kinds were reported by C. W. Gadd, J. O. Anderson and David Martin of General Motors Research. They assembled data on flexure and torsion of a 4¼ by 5-in. Diesel crankshaft, and concluded that normalized shafts proved almost as strong as the original heat treat; advantages of higher hardness 4140 steel over 5046 steel non-rolled were not evident, they reported.

... MANUFACTURING ...

Aluminum coating on exhaust and intake valves was reported to increase durability by at least 100 per

cent under certain conditions. A paper by R. F. Thomson and D. K. Hanink of GMC Research Laboratories, E. B. Etchells of Chevrolet and K. B. Valentine of Pontiac gave test data on the GMC Aldip process and described the hot dip method presently used at Pontiac.

Chevrolet also uses the process, they explained, and Thompson Products and Rich Mfg. Co. are licensed to develop and use it. Pre-coating parts with aluminum before dipping in hot flux promises economies in the future, they added.

Blades for jet engines received considerable attention. Differing processes for making blades, buckets and vanes used at Thompson Products, Inc., were explained by A. T. Colwell. These include forging, investment casting and powder metallurgy. He showed pictures of an automated broach, and polishing machines designed at Thompson to blend-in the edges and radii at tip and root, and longitudinally polish the blade. He also reviewed new materials for making blades (see abstract).

Softer compressor blades for J-47 engines were recently instituted by General Electric Co. The paper by E. M. Phillips and R. E. Weymouth detailed the advantages of increased damping capacity, resistance to stress corrosion cracking, improved impact strength, and easier heat treating and machining, using type 403 stainless of Rockwell C 26 to 20, instead of 42 to 32.

A Diesel Injection System with New Features

By S. E. Miller and T. D. Hess

American Bosch Arma Corp.

SEVERAL years of development work have been required to achieve satisfactory solutions to all of the problems of a design to include economically: spill metering; automatic, manual, or fixed timing; flange, base or shank mounting; 100 per cent excess

fuel for starting; torque-control governing; and adaptability to eight-cylinder engines. The PDA pump is a new camshaft-speed pump incorporating all of the above features.

In the pump cross section shown in Fig. 1, some of the governor parts

and the supply pump have been deleted in order that the metering process may be more easily followed. The entire pump is filled with fuel, which is delivered from the final stage filter at a pressure of five to 10 psi and which serves to supply the engine's requirements as well as to lubricate all moving parts of the pump. A rotor shaft comprised of a metering section A, a pumping section B, and a distributing section C, rotates within a distributing head D. A control sleeve E, fitted to the metering section, controls the metering and injection timing of the pump. The plungers F, with their shoes and rollers G, all turning with the rotor shaft, are forced into reciprocating motion by a symmetrical internal cam H.

Fig. 1 shows the beginning of the filling stroke as the plungers start to move apart. The fill ports are open the entire time of the plunger filling stroke, which allows the use of very low supply pressures. As the plungers reach the end of the filling stroke, the fill ports close, and with further shaft

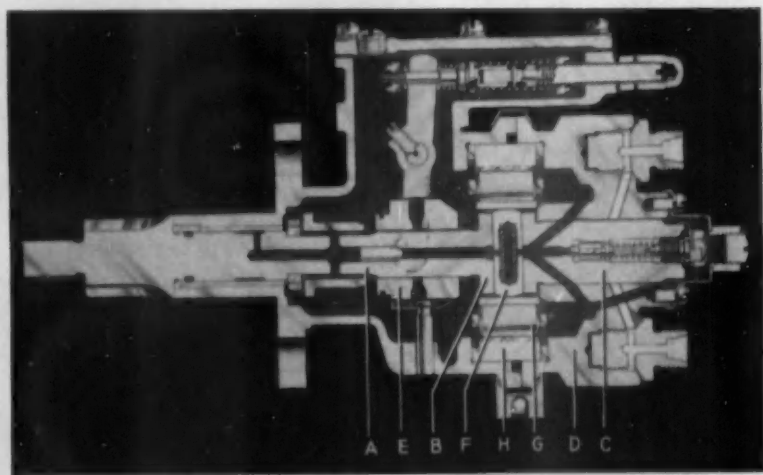


Fig. 1—Filling stroke of the PDA Diesel injector pump

rotation the plungers start moving toward each other to begin the injection stroke. At this point in the cycle a rotor metering slot is in registry with a sleeve port which permits the fuel to spill back into the sump during the initial plunger acceleration.

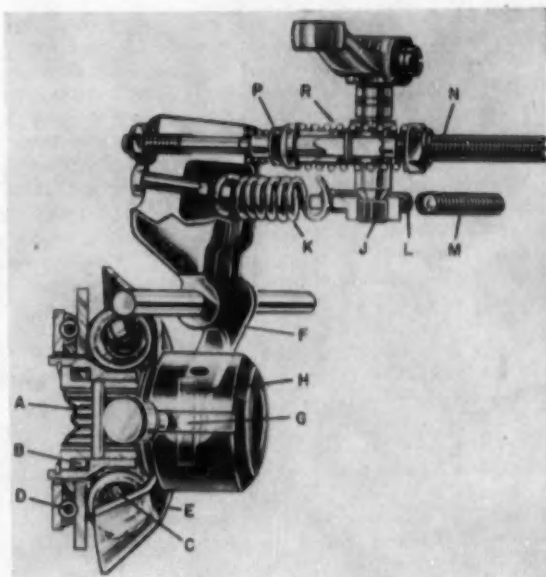
Because of the angularity of the shaft slots, the actual quantity of fuel injected will be reduced if the sleeve is moved upwardly, or increased if the sleeve is moved downwardly. Up and down movement of the sleeve, therefore, is used to control the injection quantity. In addition, if the sleeve is turned through an angle in either direction, an injection timing change occurs without change in metered quantity. It should be noted that filling of the pump is accomplished through a sump adjacent to the distributing portion of the shaft, while spill occurs in the governor portion of the housing at the metering section of the shaft. In this way a minimum disturbance of the filling function by the spilling of the fuel is effected.

The governor used is of the simple ball and single-cone type as shown in Fig. 2. In this design the governor cone is carried directly on the metering sleeve, thus eliminating any connecting linkages between the governing element and the metering element.

The governor is driven from the pump drive shaft through splined members A, which in turn drives the ball cage through a shock absorbing member B, which isolates engine torsional vibration. Six balls C, driven by the ball cage, bear against the thrust bearing D and the cone E, forcing the cone and the integrally mounted metering sleeve to the right with speed increase. The fulcrum lever F cooperates with the sleeve by means of a pin G confined by a slot H in the metering sleeve. The outward end of the fulcrum lever carries the governor tension spring K which connects with the manual operating shaft J.

The governor is shown in the idling position with the spring carrier bearing against the idle screw L, with the high speed stop screw adjustment M just to the right. The full load fuel adjustment screw N carries the resilient stop P used for torque control, and spring capsule R which provides automatic 100 per cent excess fuel delivery for starting when the manual operating shaft is in full speed position. This excess starting fuel control is set to operate only in the speed range of 0 to 500 rpm, and excess fuel

Fig. 2—Governor of the PDA Diesel injector pump



cannot be provided at higher speeds.

We have seen that an axial movement of the sleeve provides continuous metering of the fuel and that angular movement of the sleeve provides a continuous change in injection timing without affecting the metering function. The basic PDA pump has fixed injection timing accomplished by the installation of a fixed pin which prevents any angular movement of the metering sleeve. Replacement of the fixed pin with an adjustable pin allows external manual adjustment of the injection timing through a total range of five cam degrees.

Automatic timing also may be provided as shown in the figure by using engine intake manifold air speed sampled by a small venturi connected to a diaphragm operator which is linked to the injection timing lever and movable pin. Since the force necessary to rotate the metering sleeve slightly, to effect a change in injection timing, is only the friction force of the lapped sleeve on the rotating shaft, very small pressure differences are required to insure proper functioning. Entirely obviated is the need to vary timing by interposing in the pump's drive a mechanism powerful enough to oppose the working forces.

Air and Heavy Vehicle Suspensions

By ROY W. BROWN

The Firestone Tire & Rubber Co.

STEEL springs will deflect a constantly increasing amount as load is added. Air springs will maintain a constant deflection irrespective of load variation when automatically inflated through a valve connected to the body and to the axle.

It has been shown that deflection of the suspension as loaded determines the mathematical relationship of displacement, velocity, acceleration and frequency at which the load will oscillate when deflected from its static position and released. Suspension stiffness may be evaluated in terms of frequency for any type suspension on a common basis for very large as well as very small loads. The air

spring stiffness does not increase appreciably with small loads, while the steel spring becomes very much stiffer, transmitting much more of the road shock with increased damage to the material being transported.

Air springs have been made for 25,000-lb loads and may be made much larger if desired. A small air valve mounted on the body and connected to the axle will keep the largest air spring inflated to its optimum mid-position. Thus, constant springing for heavy vehicle variable loads has been attained.

Some fifty experimental air spring suspensions have been installed and tested on industrial trailers, rail cars,

motor coaches, passenger cars and heavy military vehicles. Such diversified application has developed performance characteristics, serviceability and design requirements far beyond the drawing and laboratory stage.

Compression, expansion and flow characteristics of air have been extensively worked out and are commonly available in the technical literature. Hence, discussion here may be confined to effects on the basic properties, volume, damping, inflation and effective area caused by deflection of the air containing device as applied to the vehicle suspension.

A flexible bellows of reinforced nylon tire cord construction, Fig. 1, contains air under pressure and thereby is capable of elastically supporting a load. The bellows is connected to a reservoir. Control valves to obtain "Shock Absorber" or anti-roll effect may be positioned between the reservoir and the bellows.

Performance of this simple system, Fig. 1, has been analyzed mathematically and substantiated experimentally. Briefly, for the theorist, pertinent values of load, deflection, effective area, volume, natural frequency, spring rate and reservoir size for the bellows shown are given in Fig. 2.

Inadequate damping (shock absorber effect) is the most limiting sus-

pension factor on today's fast over-the-road heavy vehicles.

Air as a suspension medium makes it feasible to provide extensive damping by controlling the back and forth air flow from the air spring bellows to its reservoir. Damping tends to minimize continued oscillation of the body following the wheels passing over a road obstruction.

Fender clearance, attachment of drive, brake and steering actuating mechanism and maintaining wheel motion with fixed relation to the chassis place a definite limit on wheel travel. Experience has shown that eight in. wheel travel can accomplish the major suspension objective without interfering excessively with basic wheel positioning functions. The problem is how can the suspension design utilize available wheel travel most effectively?

The optimum position for the wheel is mid travel at all loads. This can be accomplished with air by increasing the air pressure as the load is increased. A valve with dash pot and overtravel connected between the body and the wheel structure will admit and exhaust air with different loads, automatically keeping the wheel in mid position at all loads.

All suspensions must drive, brake and steer the vehicle in an acceptable manner before consideration can be given to improved elastic support of

the load. Many axle positioning arrangements have been used, especially in Europe on passenger cars. It is feasible now to procure, for a few cents premium, rubber rod end bushings which will last the life of the vehicle. Such bushings solve the secondary vibration and the lubrication problems in a definite and desirable manner. Hence, the future may see the heavy vehicle follow the passenger car to better and still better wheel positioning mechanisms.

"Soft" springs which permit excessive bottoming cause very high accelerations when the axle strikes the frame or bumper. Hence, the successful use of soft springs requires provision for greater wheel travel. The air spring has a marked advantage here in that automatic inflation makes all wheel travel provided in the chassis design continuously available irrespective of load variations.

Location of springs on the vehicle is an important factor in suspension performance. The high and wide apart axiom results in improved body roll under severe cornering conditions. Thus, the suspension stiffening effect, cost, weight and complicated attachment of "sway bars" may be avoided.

Air spring bellows of one, two or three convolutions provide travels of 3.75, 7.50 and 11.25 in. Load capacity is limited only by ability to install the required diameter. Softness or

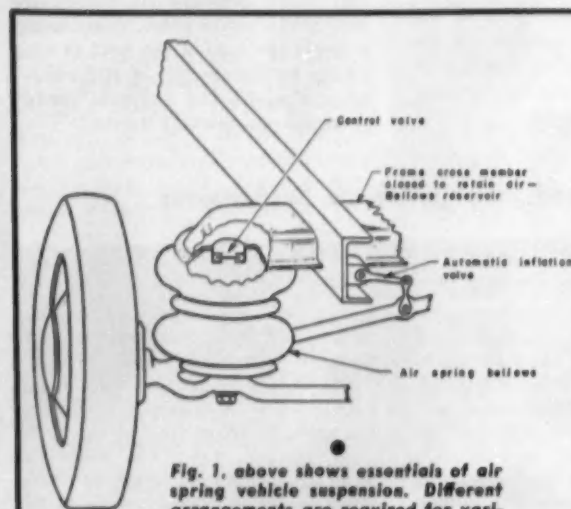
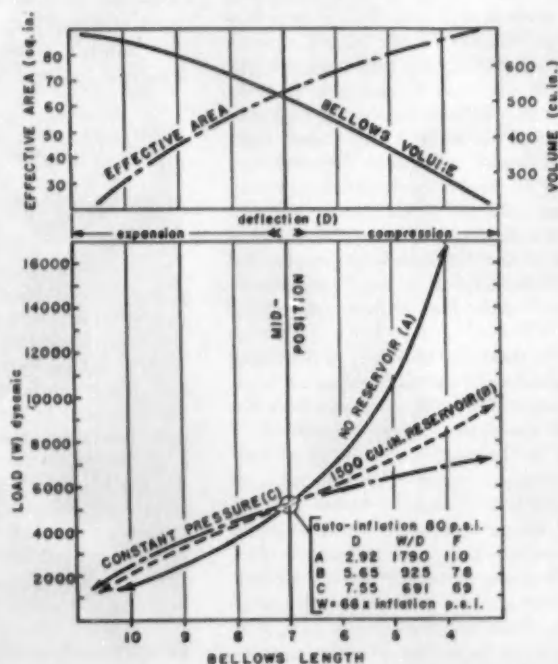


Fig. 1, above shows essentials of air spring vehicle suspension. Different arrangements are required for various axle and wheel positioning devices.

Fig. 2, at right, gives basic suspension design data for air spring bellows as illustrated in Fig. 1. Values of each characteristic may be used to best meet specific requirements. Wide selection may be made from a small group of bellows types, sizes and shapes.



low rate can be provided beyond the structural limitations of metal springs. All these with light weight

and low cost provide plus values meriting serious heavy vehicle suspension redesign.

New Material Developments in Turbine Blades

By A. T. COLWELL

Thompson Products, Inc.

Reinforced Plastic Blades

TO KEEP abreast of new materials and manufacturing techniques, Thompson Products have been studying plastic blades for the past eighteen months. Although the development is still on an experimental basis, the third stage of a compressor rotor was bladed with the fibrous glass-reinforced blades. This development originated with the idea of finding a fast and cheap method of making prototype blades. A 100-hour run at rated engine speed was successfully completed on the rotor. Inspection of the blades after disassembly from the rotor showed that they were in excellent condition. There were no signs of erosion or impending failure, and this test indicates continuation of the development.

Fibrous glass-reinforced plastics are non-critical materials. Also, the plastic blade has a relatively high damping capacity which keeps the stress low and the blade less susceptible to fatigue failure. Lightness improves acceleration characteristics of the engine because of the resulting lower moment of inertia, and starting torque also is reduced.

The plastic material exhibits practically no creep, thereby minimizing chances of stress rupture. In spin pit tests at 110 per cent overspeed for 15 minutes there was no measurable creep on a 30-in. diameter installation (disk plus plastic blade). This compares with steel blades that grew 0.001 to 0.002 in. during the same type of test. The plastic material's strength-to-weight ratio is about three times that for a compressor blade steel. Relative to its mass, the plastic's impact strength is equal to that of compressor blade steel.

Disadvantages of the plastic blade are its non-isotropic strength properties. Also, the blade will be difficult to inspect adequately.

It is now possible to produce fibrous glass-reinforced plastic materials with the ability to withstand 500 F. The blades in the 100-hour test ran at about 300 F; however, in the foreseeable future, phenolic-impregnated fibrous glass plastics may be able to

withstand approximately 700 F for about 10 hours in a compressor blade application. This would indicate favorable progress in increasing the temperature limitation of the material.

The molding job for the compressor blade is more difficult than the usual procedure for forming reinforced plastics. Closer control is required in die design, of pressures, temperatures and pre-layup phases. Experimental results to date have been excellent—dimensional uniformity and fine surface finishes are obtained. The molding process begins with the dry layup, which approximates the shape of the blade. The laminations, cut from phenolic-impregnated fibrous glass cloth, are held together mechanically.

The layup is placed in a male-and-female heated die arrangement in which it is subjected to a pressure forming cycle. When the molded part is removed it is about 90 per cent complete. At this point, the blade is to size and shape. Dimensional control is excellent. A post curing operation is then required for the resin in the blade to impart the necessary strength properties.

Cermets

Sustained effort is being put into the development of cermets for buckets and nozzle vanes. At present the product appears to have properties for developing a bucket that will operate in the 2000 F range, and it will be thoroughly evaluated in the jet engine test stand now being built, along with other engine materials. Nozzle guide vanes have completed a 100-hour engine test with encouraging results—vanes are more easily made than buckets.

Titanium

Electrolytic and thermal processes are being tried to replace the Kroll process, which is the only process at present for producing sponge. Titanium must be alloyed for successful use, and some of the alloys have been more troublesome than others.

It has been found that titanium generally requires approximately 30 per cent greater delivered force to

effect the same flow pattern as compared with steel. This necessitates careful selection of die block size and hardness. Even so, die life is considerably lower. Die sinking is more critical in that the finish is a controlling factor.

Generally speaking, lower temperatures are employed for forging titanium than are usually employed for the stainless steels. Temperature range is also more closely controlled in order to minimize grain coarsening and the formation of a hard, brittle oxide layer which is known to impart brittleness to titanium. Since no economical atmospheres have been introduced to the industry as yet, we employ air atmospheres, using electric furnace heating exclusively.

Thompson employs lubricants which were developed by our research facilities, and we have since made arrangements to secure these mixtures from commercial companies. The best lubes developed to date are still not completely satisfactory, and research is still in progress to secure better type lubricants for the various forging operations.

We use centerless ground bar stock to insure satisfactory surface quality. To further insure quality, we employ a stress relieve operation on slugs, to prevent thermal stress cracking at the cut surfaces prior to any forging operations. The slugs are prepared for the flattening operations by the extrusion process, or gather upset.

With our present forging techniques, we have found little differences in processing the various grades of titanium alloys. However, with some of the more recent alloys, such as Ti 140A and the MST 5A1 4V, we have discovered that a greater latitude of forging temperatures is permissible without encountering grain coarsening and formations of hard, brittle oxide layers.

Machining Techniques

The greatest amount of research has been expended in the field of broaching. We have found that much greater rigidity in fixturing is required plus the use of slower broaching speeds. The average speed for broaching of titanium is 10-12 fpm, while the speed for broaching the 403 stainless steel is 28-30 fpm. Broach insert materials and coolants are important details in this work.

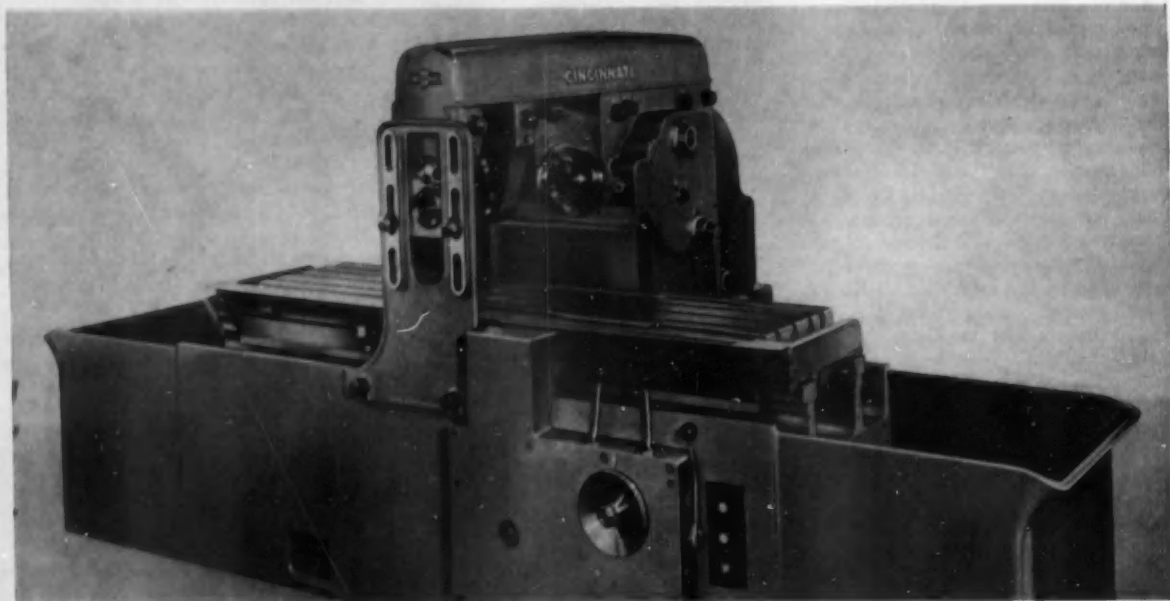
Final trimming operations on the airfoil edges must be done at comparatively low temperatures to prevent edge cracking.

NEW EQUIPMENT

PLANT • PRODUCTION

FOR ADDITIONAL INFORMATION, please use reply card on PAGE 89

Heavier Milling Machine Line for Carbide Tooling



One of the HyPowermatic heavy duty bed type milling machines

HYPOWERMATIC is the new name given to the latest line of heavy duty bed-type milling machines. The machines are equipped with automatic two-way table feed cycles and infinitely variable feed rates, and are designed for continuous operation on medium to larger size parts. Much heavier and more powerful than the superseded models, these machines offer cutting capacity up to 50 hp and spindle speeds up to 2000 rpm. They will handle conventional milling or climb milling cuts with either high speed steel or sintered carbide milling cutters.

Standard machines, designated the 300, 400 and 500 series, are built in plain and duplex styles in forty-two sizes of each, from No. 307-183 (36 in. table travel, 7½ hp) to No. 550-2614 (168 in. table travel, up to 50 hp).

The HyPowermatics feature intermittent, dog controlled automatic table cycles. Feed rates may be in-

finitely varied throughout their range of ¼ to 100 or 150 ipm, by means of a feed rate selector dial. The table is driven by a new type of unit named Hydramech. This unit, enclosed within the bed, consists of a hydraulic motor with an infinitely variable arrangement, driving a worm and dual worm wheel which in turn drives twin vertical pinions engaging the table rack. Anti-friction bearings throughout, automatic pressure lubrication system, and a built-in backlash eliminating device are other features.

Quick positive starting and stopping of spindle rotation is obtained through two hydraulically operated multiple disk clutches. Both are actuated from the spindle start-stop lever at the operator's station. Also included in the control group are the four-position directional control lever to provide engagement of the table feed and rapid traverse (right and left), the table stop, and automatic spindle stop levers.

Sixteen spindle speeds can be obtained through change gears and a back gear combination. A choice of nine ranges of spindle speeds are available. The highest group ranges from 50 to 2000 rpm for 300 Series spindle carriers, 30 to 1200 rpm for 400 Series spindle carriers and 20 to 800 rpm for 500 Series spindle carriers.

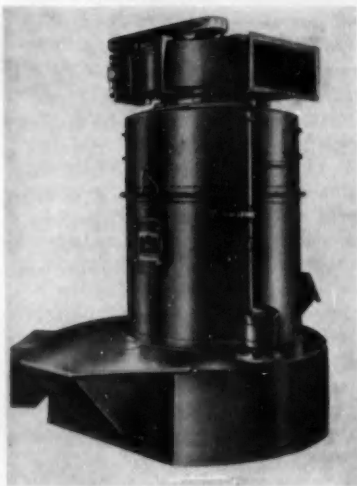
Plain HyPowermatics are equipped with the rectangular Dynapoise over-arm.

Lubrication of the principal units is completely automatic and interlocked. Coolant equipment incorporates a three-way switch, offering the operator a selection of continuous flow or automatically on and off with the starting and stopping of the spindle rotation. Chip wipers underneath the table push accumulated chips to the large chip compartments at each end of the bed. *The Cincinnati Milling Machine Co.*

Circle 56 on postcard for more data

Wet Dust Collector

A WET-TYPE dust and fume collector is being produced in a selection of models for a variety of industry-wide applications. It consists of a cylindrical drum with a series of cones and baffles. Water, supplied by a direct driven pump, cascades down-



Van-Truer dust collector

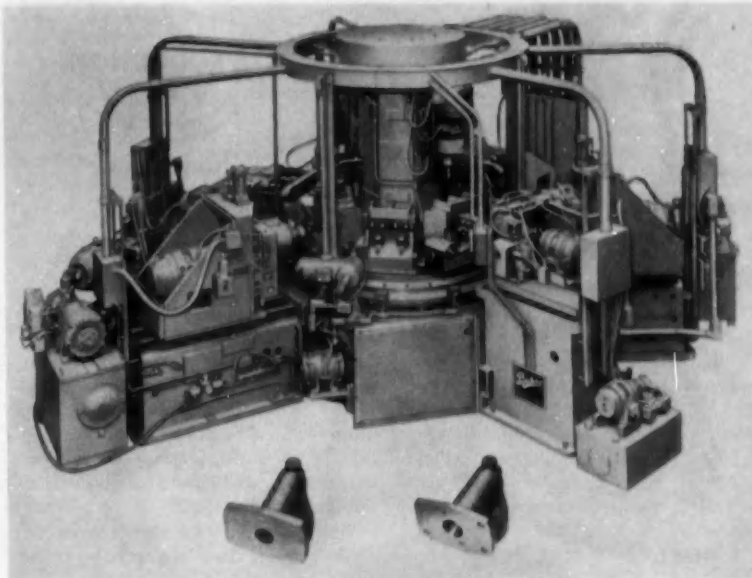
ward within the collector. This action produces a series of closely related water curtains through which the dust-laden air is filtered in its upward travel. A double row of moisture eliminators, fabricated in convenient handling size, are mounted above the washing chamber. Access doors are provided in the housing for inspection of eliminators and wash chamber.

Dust and fume laden air are in continuous fluid contact during the upward flow. It is claimed that the baffle design sets up a cyclonic washing action and turbulence, separating the wet dust and carrying it to the sludge tank below. Saturated air continues up through two-stage moisture eliminator and emerges completely dry. The flat bottom serves as a settling tank from which the water is recirculated. A chute type of clean-out is provided for easy hand clean-out.

It is stated that this dust collector is also made with a slight conveyor for ejecting sludge into a container. Various models are engineered for truss-suspension, floor-setting, or erection on roofs. Van-Truer Company, Inc.

Circle 57 on postcard for more data

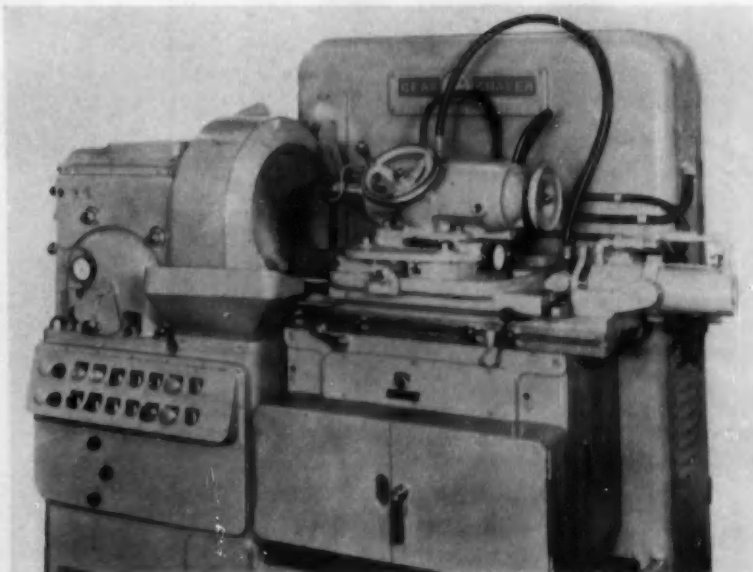
Brake Cylinders Machined Rapidly



A special machine mills, core drills, drills, reams, chamfers and taps 288 master-brake cylinder rough castings per hour gross. It is a 10-way seven-station 72-in.-center-column hydraulic-feed machine equipped with a 72-in.-diameter automatic power-driven index table, complete with shot bolt and table hold-down clamps at rough and finish milling stations. Parts, loaded two per fixture, are automatically clamped and unclamped by a power wrench with torque control. (Buhr Machine Tool Co.)

Circle 58 on postcard for more data

Shaver Controls Speed Loading



Air cylinder control on an improved model GCR Red Ring internal gear shaver machine provides fast advance and retract of the cutter head. A handwheel at the front of the cutter head allows the operator to advance the cutter with one hand while simultaneously orienting the cutter with the other hand into mesh with the work gear. This design replaces a former manual toggle-type control. (National Broach & Machine Co.)

Circle 59 on postcard for more data

NEW**EQUIPMENT****PLANT • PRODUCTION**

For additional information, please use postage-free reply card on page 89

STREAMLINED appearance sets off the mechanical improvements in a newly designed series of large stamping presses.

Two features around which the presses were designed are: conforming to Joint Industry Conference specifications; and cleanliness of layout with packaged controls. The presses follow JIC bolster, bed, die and slide area specifications and conform to blankholder and plunger dimensions. In this way, the maker points out, dies can be readily changed between presses and even between plants.

In addition, the presses are designed to be more easily equipped with loading machinery. The builder

assumes the responsibility for wiring, piping power and air line take offs and controls. These are all built into the frame.

The line includes six presses centered on single and multi-action designs for forming and drawing large stampings. The design effort was described as a cooperative one between the builder and the automotive and appliance industries.

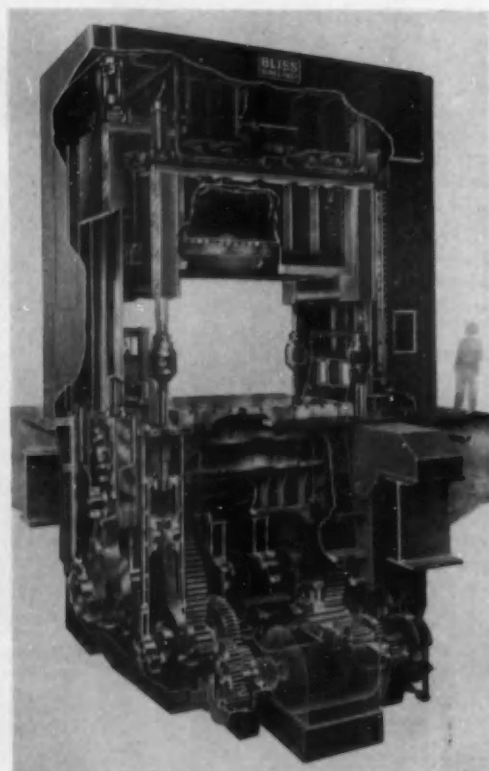
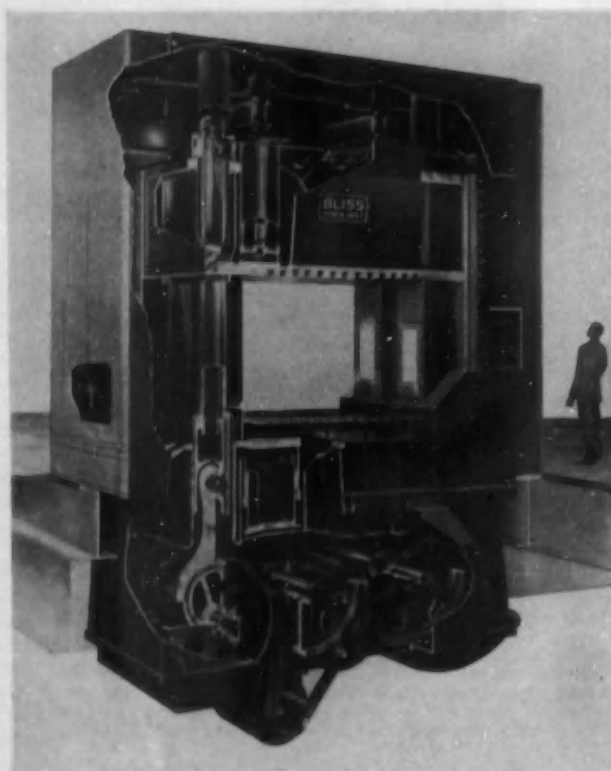
There are six new lines; three are single action, two are double action and one is triple action. Each line features heavier frames, automatic recirculating oil systems, manual and motorized plunger and blankholder adjustments, choice of air or electric clutches and front-to-back shafts.

Presses Designed

The SU-4, four point single action press is one of two underdrive models. Featuring low overall height for maximum clearance, these presses also put maintenance on the lower level out of the way of production. The SU-4 counterbalances are in the slide. Side thrust is said to be at a minimum through the extra long gibs and connections. The TU-4 is a triple action four point version. In it the drive is direct through a motor with interlocked air brake. Crankshafts drive both plunger and blankholder through a single toggle mechanism, for greater dwell. Other features include motorized holder adjustments, pre-stressed pull-down rods, and speeds up to 10 strokes per minute.

The fully enclosed S-4, four point single action press was designed for work with deep front-to-back dimensions. It features four main gears with eccentric gears on one side of each main gear. The 2000 ton model is shown.

A full eccentric single action press,



With Automation in Mind

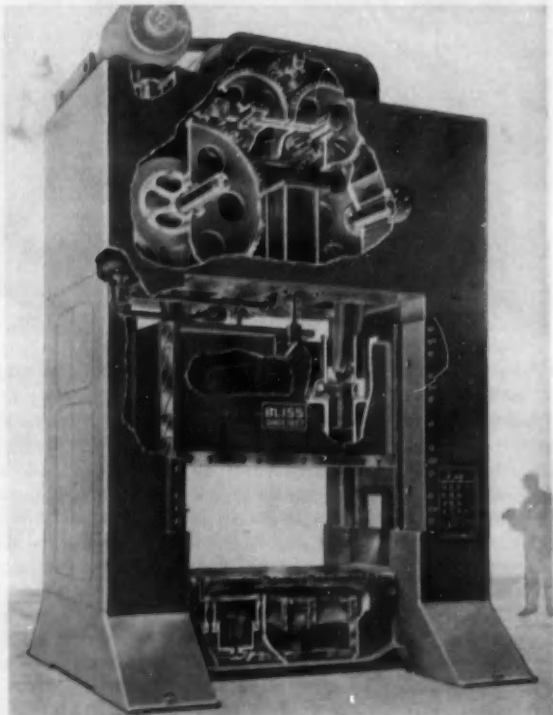
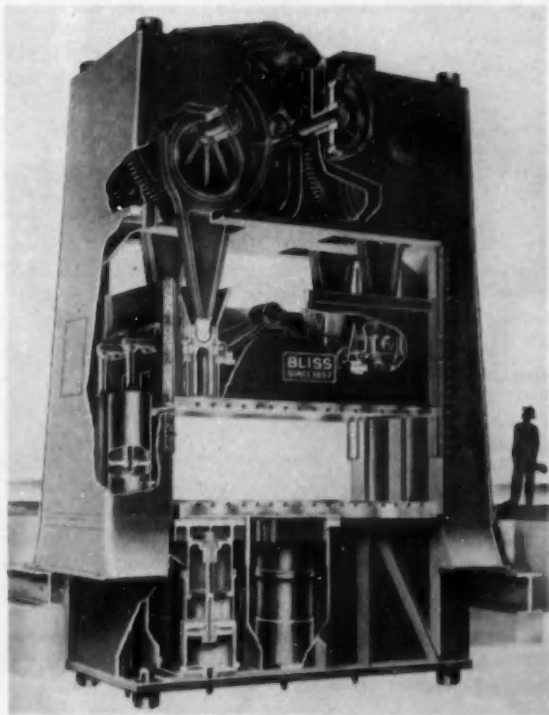
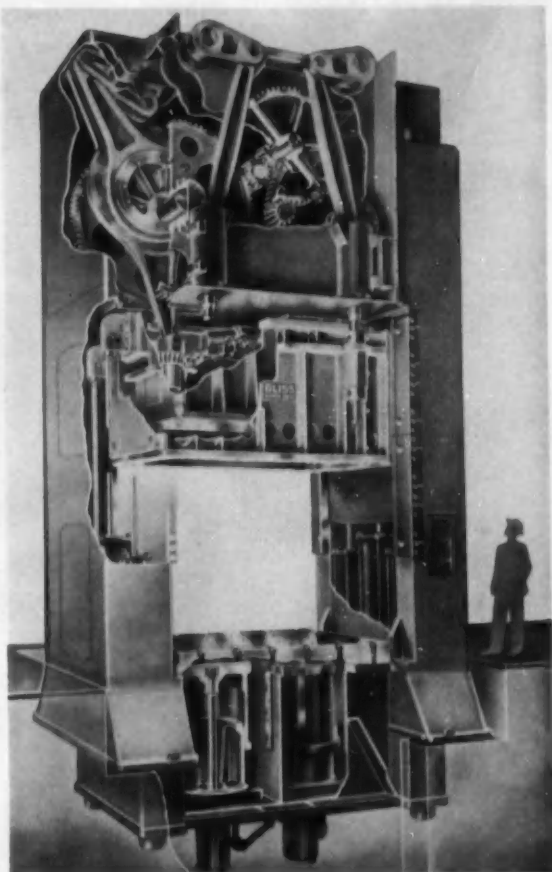
the SE-2, in the 250 ton size shown operates at up to 25 strokes per minute. It is double geared and is of four piece tie rod construction. These presses are available in sizes up to 2000 tons.

A double action eccentric two point press, the D-2, has air counterbalance cylinders built into the uprights to reduce crown height. Four piece shrunk tie rod construction is designed for ruggedness and accurate alignment. The deeper crowns include the bottom of the main gears. This feature is said to add to the crown strength and simplify lubrication. Blankholder screw slides are mounted in the crown for increased rigidity. The double gears operate full eccentric and are symmetrically located. A pneumatic friction clutch operates the press at 10 strokes per minute.

Not shown is the D-4 four point double action press with similar features. The complete line of presses was designed with the cooperation of the automotive and appliance industries, according to the maker, E. W. Bliss Co.

Circle 60 on postcard for more data

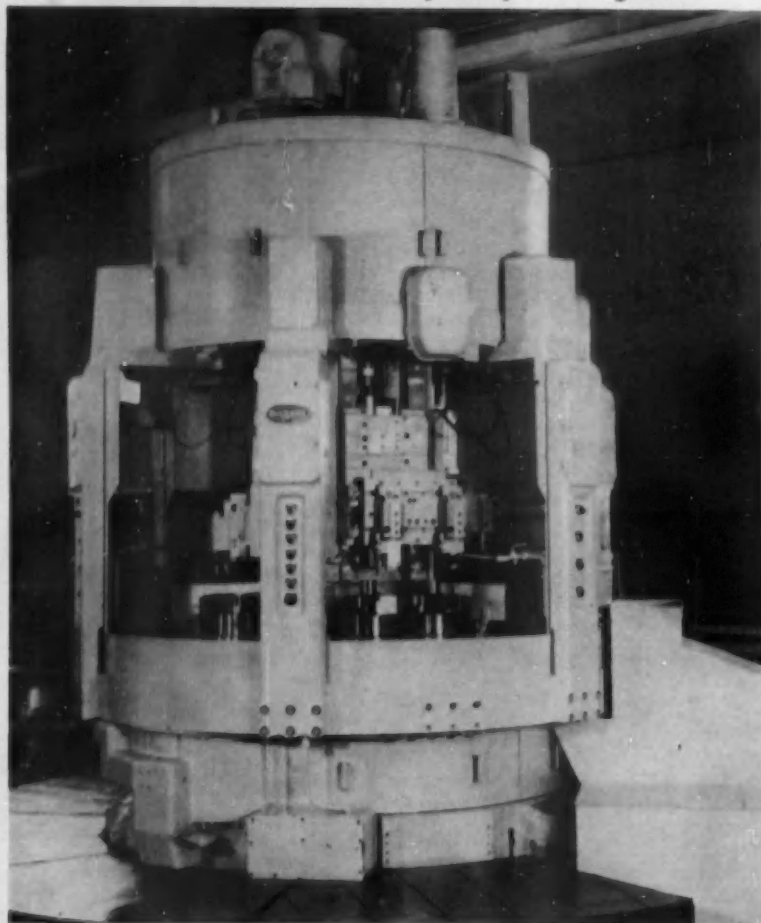
Cutaway illustrations of the new Bliss press lines are from left to right below: models SU-4, TU-4, S-4, SE-2, and at right model D-2.



NEW**EQUIPMENT****PLANT • PRODUCTION**

For additional information, please use postage-free reply card on page 89

Mult-Au-Matic Line Completely Redesigned



The 10-in., six-spindle model L Mult-Au-Matic

TYPE L Mult-Au-Matic is the latest version of the multi-spindle vertical chucking machine, of which there have been several successive models since its original concept in 1914. It is the third in the firm's line of newly designed machine tools announced in recent weeks.

Two outstanding features are the push-button control system, which facilitates head setting and tool adjustment with a minimum of effort, and a completely new screw type of feed mechanism. The screw feed has a total available stroke of 16 in., and

offers more constant advance of the cutting tools to the work than previously available. Also, since only the required portion of the total stroke need be used, considerable time-saving in the automatic cycle is accomplished.

An improved type of mechanism permits faster spindle carrier index. Index registry and a new type of spindle bearing mounting result in accuracies to a degree never before attainable in this type of machine.

Selective feeds and speeds at each work station are made through the

use of a new type of gear synchronizer. For example, in the 10 in. machine, spindles may be geared to run up to 1000 rpm as the spindles on the carrier are indexed.

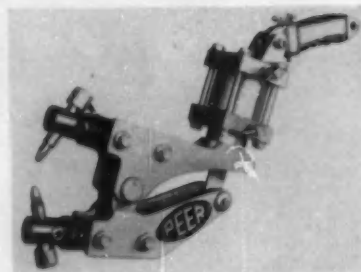
The machines are of heavier construction, permitting input of up to 150 hp. A full line of accessories is available, such as multi-purpose heads, drill heads, tapping heads and precision boring heads. Also, automatic loading devices, automatic gaging equipment and chip conveyors are included as extra items.

The complete line of type L machines is available in 10-in. size built with 6, 8, 12 or 16 spindles; 14 and 18-in. sizes will be built with six or eight spindles. They offer 49 spindle speeds in two ranges: 55-500 and 110-1000 rpm for 10-in. and 14-in. models, and 33-300 and 55-500 rpm in the 18-in. models. There are 73 feed rates per revolution of spindle speed. Ten-in. machines have two spindles per station. All machines have double index. Heads include plain vertical, universal, and double purpose, with 4½-in. maximum cross travel. Single or multiple spindle drill heads are available. *The Bullard Co.*

Circle 61 on postcard for more data

Portable Welder

LIGHT-WEIGHT, heavy-duty portable gun welders are engineered to speed production on large sheet metal and wire assemblies. Gun welder units are available in 30 to 100 kva capacities for either air or air-hydraulic operation on 220, 440 or 550-v power supplies. Six basic gun types are available for special applications. Associated operating equipment in-



Scissor type portable gun welder

cludes: water-cooled flexible cables, overhead suspended transformer with balancing arm, timing and contactor controls. Optional features include: ball bearing suspension, extra long or retractable stroke, spring balance for maximum vertical movements, special jaws and electrodes. *Peer Incorporated.*

Circle 62 on postcard for more data

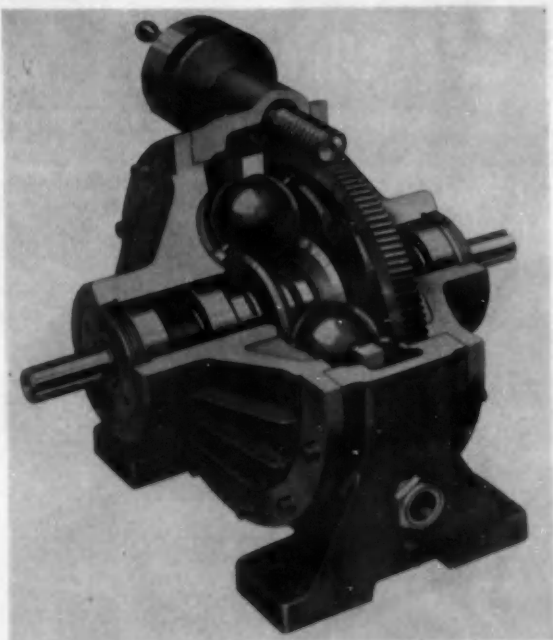
Novel Variable Speed Drive Is Ball Type

JUST announced as the newest addition to a line of power transmission equipment, the Speed Variator is now available in nine sizes, ranging from one-half to 10 hp at 1750 input rpm. The new variable speed reducer has several unique features, including the following:

Power is transmitted from the input shaft to the output shaft through alloy steel driving balls which are in pressure contact with disks attached to the two shafts. Relative speeds of the two shafts are adjusted steplessly through a 9:1 range (from 1/3 to three times the input speed) by changing the angular positioning of the axes on which the balls rotate. Coaxial input and output shafts rotate in the same direction, either clockwise or counter-clockwise. Speed is regulated by a simple manual adjustment, with indicator, or by manual or power operated remote control devices. *Cleveland Worm and Gear Co.*

Circle 63 on postcard for more data

The Cleveland ball-drive Speed Variator was re-engineered from a Swiss invention, to fit American practices.

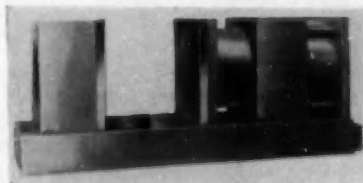


Checks Ball Waviness

THE Ball Wavometer is an inspection instrument for measuring the waviness of balls from 1/16 to 1 1/4 in. in diameter. It shows the rms average height of the irregularities in surface contour that occur from three to 100 times around a major circumference of the ball. The readings are shown by a meter for each of two wave-bands, in microinches. A range selector switch for each wave-band provides full-scale readings of 1, 3, 10, 30, 100 and 300 microinches. An oscilloscope is furnished if desired, to show the general shape, spacing, and approximate number of waves in either wave-band. *Micrometrical Development Corp.*

Circle 64 on postcard for more data

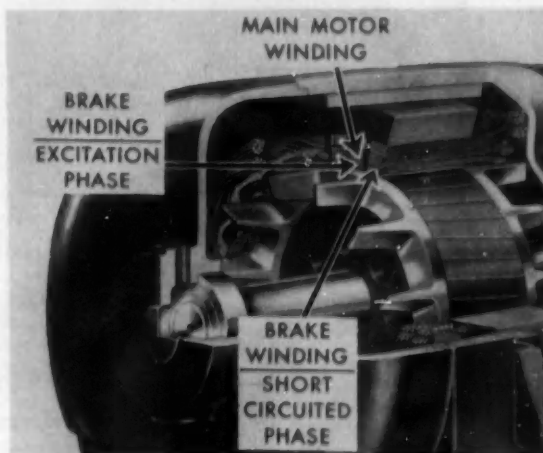
Air Vise



Vi-Speed Autovise model 663 features six by six in. jaws, backed with a 4 1/4 in. diameter push rod. Removable jaws open to eight in. on standard units. Spring return air cylinders have 19:1 ratio on any line pressure to 150 psi, with three-in. air stroke. (Van Products Co.)

Circle 65 on postcard for more data

Brake In Motor Housing



A multi-power, two-phase brake winding is super-imposed on the standard stator winding. One phase of the brake winding is connected to a single phase line during the braking operation. Second phase is permanently short-circuited.

UNIBRAKE a-c dynamic brake motors now are available up to 30 hp and larger sizes are being developed. With no moving parts, this feature is built into standard frame single or polyphase induction motors.

The braking action is a two stage process. Single phase current is super-imposed on the excitation phase of the multi polar brake winding producing dynamic braking torque down to its synchronous speed. Then the rotor feeds power into the short-circuited phase of the brake winding continuing the braking action down

to zero speed. The braking is smooth and continuous providing a rolling stop. Since the brake winding is taken out of the circuit at zero speed there is no holding powtr. Unibroke dynamic braking can be built into all of the firm's regular line of standard motors, right angle and parallel gearmotors and mechanical variable speed drives. There are no limitations as to mountings, enclosures, electrical characteristics, speeds or special mechanical modifications. *Master Electric Co.*

Circle 66 on postcard for more data

NEW

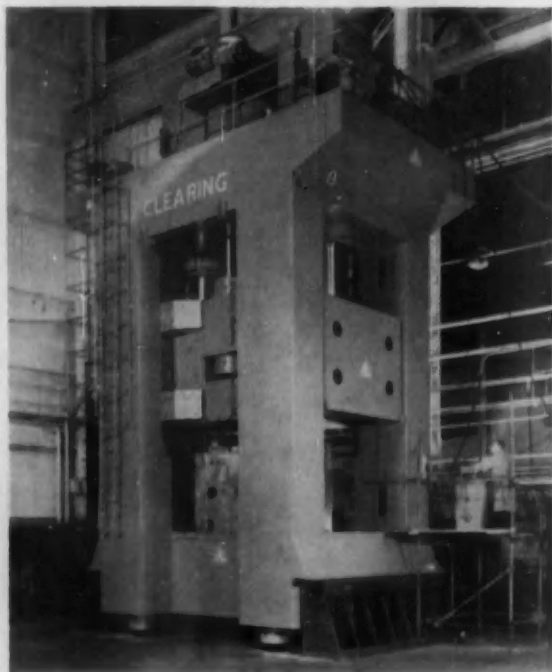
EQUIPMENT

PLANT · PRODUCTION



For additional information, please use postage-free reply card on page 89

Press to Trim Aluminum Forgings



This 2000-ton press was designed to trim aluminum forgings. It provides continuous pressure over an unusually long stroke. For forgings varying greatly in size, it permits quick adjustment of the stroke length. Housing type machine is of pre-loaded tie-rod frame construction, for off-center loading. Break-through shock is controlled by the slide pressing against a cushion cylinder, which reduces the pressure setting by exhausting its volume through a fixed orifice. When the slide breaks through the work, the hydraulic system is decompressed gradually. (Clearing Machine Corp., Div. of U.S. Industries, Inc.)

Circle 67 on postcard for more data

Hand Pushbutton

DESIGNATED as the 1PH1, an aluminum-covered switch is designed to



The M-H hand pushbutton for presses and similar equipment.

fit into conventional FS and FD electrical boxes. It is 2 1/4 in. in diameter, providing a large target for easy manual operation and features a snap-acting spring which gives users a good "feel" of the pushbutton action.

A neoprene gasket between the base of the switch and the mounting surface and a seal boot between the button and plunger mechanism seal the switching unit from oil and other foreign matter. Flutes and holes in the cover plate are provided for the escape of any chips, dirt or oil which may travel inward with the plunger.

The switching unit has two double-break circuits—one normally-open and one normally-closed. A snap-action spring causes one set of contacts to break before the other set makes contact.

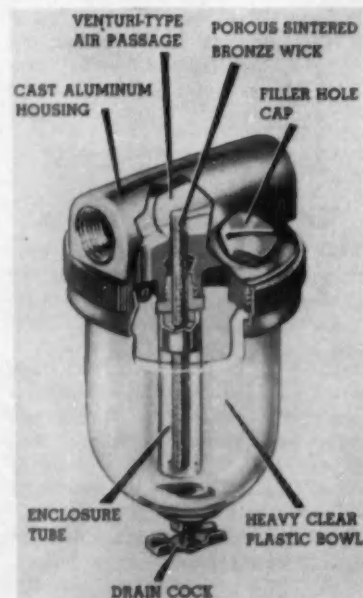
Pilot duty rating of the switch is six amp normal and 60 amp inrush at 125 v ac; three amp normal and

30 inrush at 250 v ac; 1.5 amp normal and 15 inrush at 480 v ac; and 1.2 amp normal and 12 amp inrush at 600 v ac. Micro Switch, Div. of Minneapolis-Honeywell Regulator Co.

Circle 68 on postcard for more data

Air Line Lubricator

REDESIGNED air line lubricators employ a porous sintered bronze wick with a new clear plastic enclosure tube to provide two oil feed ranges—a high range using the enclosure tube and a low range with the enclosure tube removed. Three rings



Keller improved lubricator

on the wick provide a visual indication of the adjustable wick height in the air stream.

Two orifice inserts reduce the rated air capacity for low airflow applications, such as for lubricating pulse-type air cylinders or bearings. The insert with the larger hole provides a normal feed of oil when air is flowing at 75 to 80 per cent of air capacity with no orifice insert. The smaller hole insert provides oil feed at 35 to 40 per cent of normal air flow.

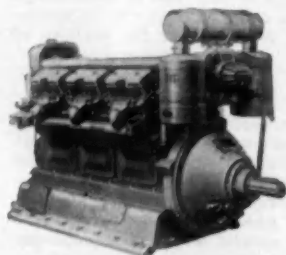
Lubricating oils from light spindle oil through SAE No. 10 may be used, including rust and oxidation inhibited oils in this range. Keller Tool Co.

Circle 69 on postcard for more data

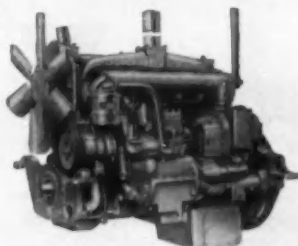
SOME FAMOUS ENGINES EQUIPPED WITH SCHWITZER-CUMMINS TURBOCHARGERS AND SUPERCHARGERS



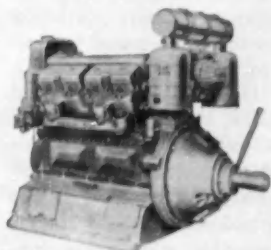
Model 687-C—Harnischfeger Corporation
6 cylinder, 2 cycle using two S-C
superchargers.



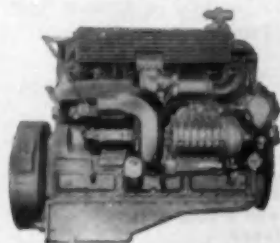
Model D-397—Caterpillar Industrial
Diesel V-12.



Model D-337—6 cylinder—
Caterpillar Diesel.



Model D-375—Caterpillar Diesel V8.



Model HRBS-600—Cummins Engine Com-
pany, Inc. (Used also on HBS Series.)

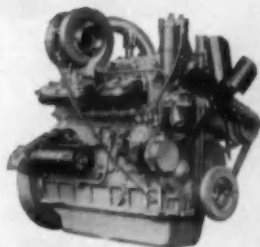
POSITIVE DISPLACEMENT TYPE—EXHAUST DRIVEN TURBOCHARGERS

More than twenty-five years of research, intensive engineering, wide field experience and unexcelled manufacturing facilities are back of our product.

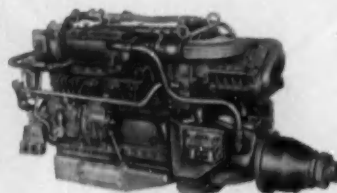
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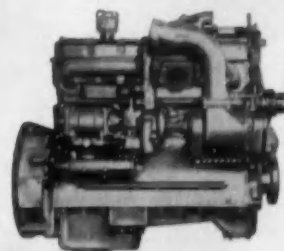
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with Schwitzer-Cummins Turbocharger.



Model D1X6ES—Hercules Motor Corporation
Diesel with Schwitzer-Cummins Supercharger.



Model JBS-600—Cummins Engine Company, Inc.
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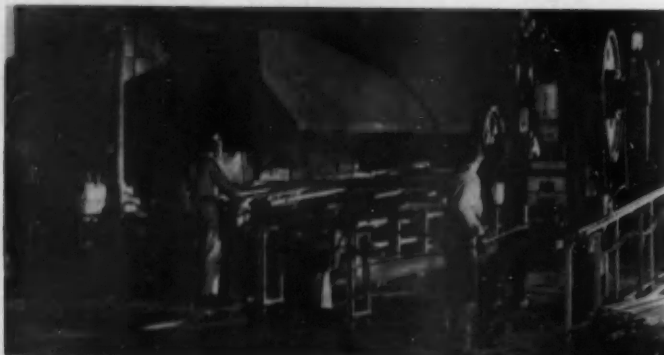
SCHWITZER-CUMMINS COMPANY

1125 MASSACHUSETTS AVE. • INDIANAPOLIS 7, INDIANA

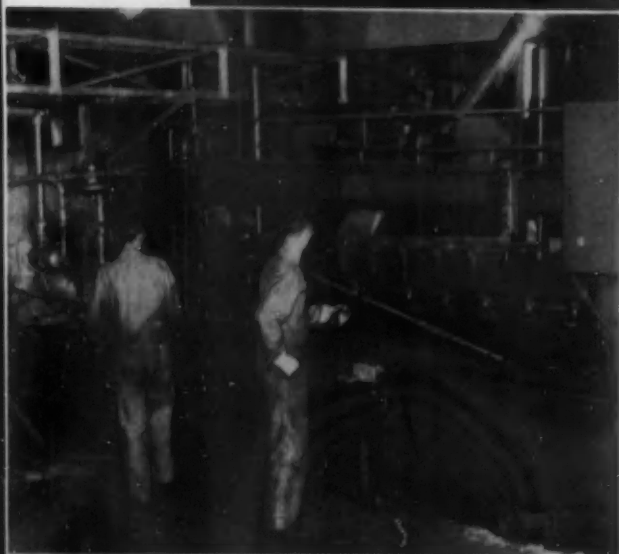
Making TORSION BARS

for New Passenger Car Suspension

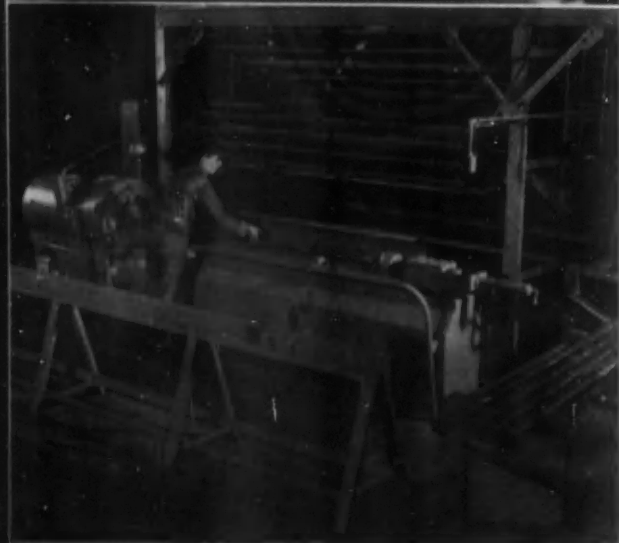
By Joseph Geschelin



Perspective of the three initial operations on torsion bars. The bar end heating furnace is arranged in the background, feeding heated bars to the operator at the left. Here the end is upset to hex form in a Hill-Acme upsetter. The bar then is transformed by a chain conveyor to the operator at the right for restrike of the upset end.



Immediately following upsetting of hex ends, the bars go through the furnace at left, (in the second illustration), then move by automation—not installed at the time this photograph was taken—into the special Gogan die quenching machine in the foreground.

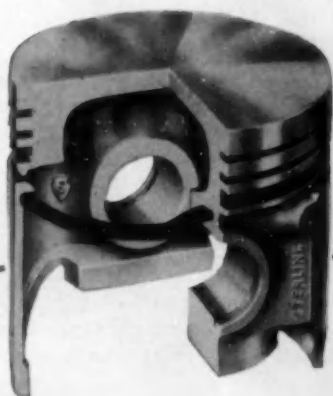


INTRODUCTION of 1955 cars threw the spotlight dramatically on the pioneer installation of a unique torsion bar suspension system on several models of well-known makes. It marks the first radical change in suspension systems since the adoption of knee-action front suspension early in the '30's.

It will be of interest to our readers to learn that the system of four torsion bars—two suspension bars, two compensator bars—is being manufactured on an economical mass production basis by Maremont Automotive Products, Inc., in its specialized plant in Cicero, Ill. This plant was described some time ago (see AI, May 15, 1953) when it was in operation exclusively as a facility for producing torsion bars for military vehicles. The writer noted at the time that the know-how and specialized facilities initiated then should provide a valuable contribution to the automobile industry, if and when motor cars would employ a torsion bar suspension.

(Turn to page 98, please)

This is the specially designed Maremont twisting machine for presetting the long, slender bars. After being twisted, the bars are loaded on the bar conveyor leading to the paint dip and drying oven in the background.



1953

STERLING introduced a new, amazing piston

1954

ONE car manufacturer selected the new piston

1955

7 Manufacturers specify **STERLING CONFORMATIC* PISTONS**

In 1956... there will be more! This quick acceptance by automotive engineers is a result of the demonstrable superiority of Sterling Conformatic Pistons. Sterling Engineers will be glad to show you how Conformatic Pistons can improve your engine's performance. Conformatic eliminates cold slap, scuffing and frictional power losses... because it conforms exactly to the cylinder walls over the entire operating range. Your Sterling Engineer can give you complete details and arrange a test.

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AUTOMATION NEWS REPORT

FEEDBACK

AUTOMATIC CONTROLS
PRODUCTION — VEHICLES — AIRCRAFT

By Paul Kennedy

DATA PROCESSING, CROSS-COUNTRY

For the first time a manufacturer doing voluminous calculations is raising the speed of data transmission to that of the fast data reduction systems now available. General Electric has joined electronically four scattered engineering and computing centers.

Linked in the communications system are GE plants in Evendale, Ohio, where the computing center of the Aircraft Gas-Turbine Div. is using the huge Model 701 data processing machine built by International Business Machines Corp. on three shifts daily; the Medium Steam Turbine, Generator and Gear Dept. at Lynn, Mass., the Large Steam Turbine-Generator Dept. at Schenectady, N. Y.; and fourth point in the hookup is IBM's Technical Computing Bureau in New York where GE will rent a second 701 for an eight-hour shift daily. The link in this system duplicates sets of punched cards at these points by means of telephone, telegraph, or radio circuits. The Transceiver hookup will handle up to 11 fully punched cards per minute. It augments a network of telegraphic equipment which GE has been using to deliver its problems and answers from turbine departments to the computing facility.

C-W INTO ULTRASONICS

Curtiss-Wright Corp., Wood-Ridge, N. J., says the applications of ultrasonics to a variety of industries is so promising that it has entered the equipment field. It will build and service a broad line of ultrasonic generators under license from Dr. Lehfeldt & Co. of Germany. A so-called Diatron drill is designed to cut holes of any shape without rotating movement. The drill employs an abrasive suspended in a liquid and distributed over the cutting soundhead in a thin film. Frequency is 25,000 cycles per second. A parts-washing device for delicate parts is being offered, as well as a laboratory unit for working out new techniques with various soundheads on different products, an internal flaw detector for quality control of sheet stock or fabricated parts, and a similar device for parts which can be tested only from one side.

CONTROLS ROAD SHOW

You may have seen the traveling display of voltage control equipment put on the road by Superior Elec-

tric Co., Bristol, Conn. The trailer-load of transformers, regulators, power supplies and other items is a permanent part of the firm's service to users, manufacturers and distributors.

SPERRY PRODUCTS EXPANSION

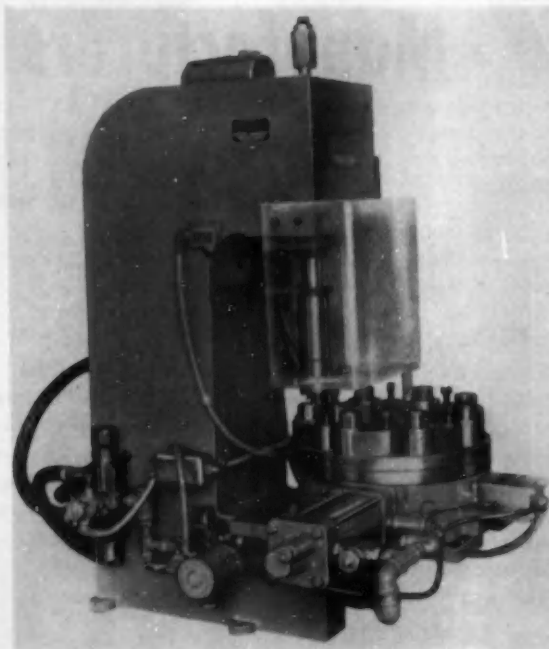
An electric motor load measuring device called Protection will be put into production by Sperry Products, Inc., of Danbury, Conn. The device formerly made by Brinnel Co. warns machine operators whenever the mechanical load and hence the electrical load exceeds a safe limit.

CONSOLIDATED-PHILLIPS AGREEMENT

Consolidated Engineering Corp. president Philip S. Fogg announced an agreement with Phillips Petroleum Co. to manufacture and market nationally the latter firm's continuous plant analysis and control instruments. The Pasadena, Calif., firm will handle infra red gas analyzers, differential refractometers, ultraviolet analyzers, and oxygen analyzers.

ELECTRODATA'S NEW OFFICE

ElectroData Corp., computer affiliate of Consolidated Engineering Corp., has opened an eastern regional sales and service office in the Chrysler Bldg., New York City. Lloyd W. Cali has been named acting manager of the office.



Combining a standard press and eight-station index table, Saginaw Steering Gear Div. assembles steering knuckles at 1800 per hour. This setup provided a 50 per cent increase in production. Operator loads the parts in front of transparent guard, and assembled parts are unloaded automatically into a chute. Equipment by Air-Hydraulics, Inc., can be adjusted for slight variations in stock thickness.

94%

is an overwhelming preference

Yes, 35 out of 37 engine manufacturers using

chrome rings specify



piston rings!

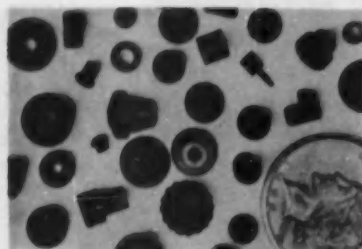
Automotive engineers prefer Perfect Circles because Perfect Circle offers:

1. Quality Control 2. Sound Engineering 3. Service 4. Experience 5. Proved Performance

Perfect Circle Corporation, Hagerstown, Indiana; The Perfect Circle Co., Ltd., Toronto, Ontario

NEW PRODUCTS.

FOR ADDITIONAL INFORMATION, please use reply card on PAGE 89

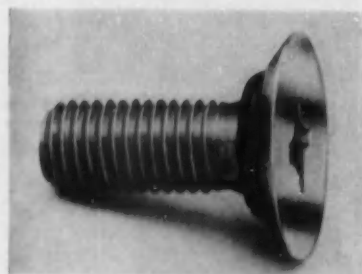


Rubber Parts Meet Close Tolerances

Custom molded rubber parts having complex structure as shown can be produced in miniature with dimensional tolerances as close as ± 0.001 in. by means of injection molding. Other shapes and designs can be made to customer specifications. Properties of the injection molding process permit greater quality control on these

miniature rubber parts by eliminating the flash found in compression molding and such secondary operations as hand or machine trimming. Compounds of Neoprene, Buna N and Silicone synthetic rubbers can be injection molded for these applications. *Minnesota Rubber & Gasket Co.*

Circle 46 on postcard for more data



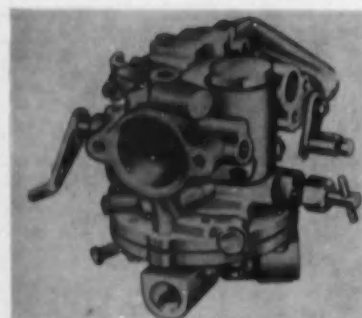
Flush Bolt Features Sealant

A one-unit, sealing flush bolt called Bolt-O-Seal features the controlled confinement of a rubber sealing gland. It is based on the same principle employed in the company's Lock-O-Seal and other fastener sealing devices. There is said to be no loss of sealing due to cold flow. Memory factor of the rubber is always retained, as it is not deformed beyond its elastic lim-

its. Metal to metal contact assures maximum strength.

Standard sizes and styles seal gases or liquids up to a maximum of 50 psi. For higher pressures specially ground bolts are furnished. The bolts are also available in titanium, and with many special rubber compounds. *Franklin C. Wolfe Co.*

Circle 47 on postcard for more data



Carburetor Tilts

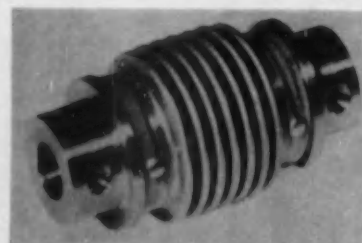
Operation in vertical, horizontal or any tilt positions without a swiveling mechanism is possible with models H and HP diaphragm carburetors. Designed specifically for power chain saw use, this dry type carburetor has a pressure sensing diaphragm admitting fuel directly to the engine. No fuel is admitted to the carburetor until the engine aspirates. *The Tillotson Manufacturing Co.*

Circle 48 on postcard for more data

Transit Fabric

A vinyl plastic coated upholstery fabric engineered for heavy-duty transportation seating, *Fabrilite Transit Special* combines flexibility over a wide temperature range with high abrasion resistance. The heavy coating of vinyl on a rugged sateen base is formulated with a non-migratory plasticizer and features a dry finish that minimizes soiling. *Du Pont Co.*

Circle 50 on postcard for more data



Stainless Coupling

This precision bellows coupling will join misaligned shafts of the same or different diameters. The stainless steel unit is for low torque requirements. Standard shaft sizes are $\frac{1}{8}$, $\frac{3}{16}$ and $\frac{1}{4}$ in. Either set screws or fixed pinning may be used. *PIC Design Corp.*

Circle 49 on postcard for more data

Hose Adapters

The SFG connector for re-usable *Hoze-lok* fittings for hydraulic hose has a swivel nut on one end and male *Dryseal* pipe thread on the other. It permits installation where direct mounting would result in twisting of the hose. *Tube & Hose Fittings Div., Parker Appliance Co.*

Circle 51 on postcard for more data

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FREE LITERATURE

Fractional-Hp Motors 1

Bulletin F 3959-2 describes features and performance characteristics of Barcol heavy duty type YAR unidirectional motors up to 1/20 hp. Barber-Colman Co., Small Motors Div.

Steel Cutting Guide 2

Relative machinability, using B-1112 as standard, of fast-cutting carbon, alloy and stainless steel is compared in new bulletin which also summarizes other principal characteristics of some 17 different analyses. Joseph T. Ryerson & Son, Inc.

Fine Copper Strip 3

Bulletin 5 presents general information on precision-rolled beryllium copper, phosphor bronze, nickel silver, chromium copper and copper strip to tolerances of ± 0.0001 and ± 0.0002 in. Penn Precision Products, Inc.

Flowed-In Gasket 4

Machines and tunnel-type drying ovens for applying synthetic gaskets to parts spinning in a chuck are described in a 12-page booklet. One is semi-automatic and can gasket up to 50 parts a minute. The fully automatic machines have rates of 70 to 300 parts per minute. Dewey and Almy Chemical Co.

Oscilloscope 5

Information detailing four- and six-channel oscilloscopes, and universal and dual channel d-c amplifiers is provided in new brochure offered by Brush Electronics Co.

Rubber, Plastics Guide 6

A design primer of molded and extruded rubber and extruded plastics is offered in a 16-page Buying Guide, catalog 786. The General Tire & Rubber Co., Industrial Products Div.

Industrial Trucks 7

Gasoline, Diesel and LPG industrial lift trucks in capacities from 1000 to 10,000 lb are shown and specified in 12-page bulletin 5101C. Yale & Towne Mfg. Co.

Stainless Tubing 8

In addition to defining the many finishes, size ranges, types and shapes of stainless tubing available to industry, six-page folder TB365 contains a table of condensed properties and processing data for nine popular grades of stainless tubular products. Babcock & Wilcox, Tubular Products Div.

(Please turn page)

2/1/55

VOID After Apr. 1, 1955

Circle code numbers below for Free Literature, New Plant Equipment, or New Product Information

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41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
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Wood Truck Body 9

Origin and development of the all-wood military truck body with step-by-step details of its construction, is featured in the booklet, *Wood Research No. 17*, issued by *Timber Engineering Co.*

Short-Run Stampings 15

Examples to point out costs of tooling and making the first thousand pieces are given in bulletin 201. Factors that help to cut down cost of stampings are discussed. *Federal Tool & Mfg. Co.*

Test On Oil Filter Cartridges 10

Performance of thread filters and paper filters in laboratory test equipment designed to simulate actual use in automotive cartridges is published in a 20-page report available from the *Institute of Thread Machinists.*

Resistance Welding 16

Bulletin 333 is a general machine catalog for electric resistance welding. Three application stories involving mild steel, stainless steel and aluminum are described. Pictures show the firm's facilities. The book explains single phase, three-phase and three-phase Modu-Wave cycles. Welders including spot, rocker arm, seam, roll-spot, specials, flash-butt, portables and accessories are pictured. *Sciaky Bros., Inc.*

Carbide Tools 11

Condensed catalog GT-285 reflects latest price changes and specifications on all standard cemented carbide tools and blanks. *Carbology Dept., General Electric Co.*

Flanged P-M Motor 17

Details of the type PM-36 permanent-magnet motor are given in leaflet PM36-954. It is a 20-watt 6000-rpm unit recommended for applications where high efficiency, good speed regulation, and low r-f interference are required. *Dalmotor Co.*

Wire Containers 12

Technical details on welded steel wire mesh containers, including case history examples of cost reduction accomplished in a wide variety of industries, are pictured in a 24-page brochure. Also included is the application of welded wire pallets and industrial bulkheads. *Pittsburgh Steel Products Co.*

Fluid Power 18

A complete line of fluid power pumps, motors, transmissions, cylinders and valves to handle up to 150 hp is described in bulletin 10051-D. *The Oilgear Co.*

Reamers 13

New eight-page release covers a variety of precision-ground reamers, including hand reamers, shell, expansion, taper pin, stub, chucking, decimal and dowel pin reamers. A selection of shell reamer arbors is also shown. *The DoALL Co.*

Horizontal Machines 19

Floor type horizontal boring, drilling and milling machines are illustrated and described in a 14-page bulletin, No. 954, available from the *Cincinnati Gilbert Machine Tool Co.*

Drill Rod 20

A descriptive leaflet on high speed, carbon and alloy steel drill rod includes data on grades, lengths, size ranges, finishes and tolerances together with composition. *Allegheny Ludlum Steel Corp.*

Die Cast Finishing 14

Application of airless abrasive blasting to the deflashing, deburring, surface preparation work, and elimination of porosity by airless blasting, is illustrated by case histories in bulletin 101-D. *American Wheelabrator & Equipment Corp.*

Oillite Stock 21

Catalog CB-54-1 lists nearly 600 Oillite standard size cores, bars and plates available from the *Amplex Div., Chrysler Corp.*

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CATERPILLAR

NOW USES

LEDLOY 5120

Saves on Every Pre-combustion Chamber Assembly

In today's competitive market, any savings on a component is important, even on a product as large as the Caterpillar D8 crawler Tractor. Caterpillar Tractor Co., with an eye on costs, selected Ledloy 5120 for pre-combustion chamber assemblies in their diesel engines. As a result, machining costs have been reduced on each of the two parts that form the finished assembly. This reduction resulted from Ledloy's free machining properties, which reduced machining time and increased tool life.

Design called for copper brazing the two pieces together and nickel plating the entire assembly. *The Method:* The leaded steel was brazed and plated in the usual way, without special handling. *The Results:* Pre-combustion chamber assemblies made of Ledloy 5120 at a lower cost, met all requirements and are seeing service in Caterpillar-built machines around the world.

* Inland Ledloy License



COPPERWELD STEEL COMPANY
(Steel Division) WARREN, OHIO



Two component parts of the Pre-combustion Chamber assembly were machined from Ledloy 5120 cold drawn bars. Other leaded alloy steels and leaded carbon steels are available in all standard or S.A.E. compositions in any of our standard sections. Write for complete information about application of leaded steels to your product.

SEND FOR FREE
BOOKLET ON
LEAD-TREATED
ALLOYS



News of the MACHINERY INDUSTRIES

(Continued from page 47)

siphon or gravity flow pipe to a reservoir containing piston unit. The piston unit is thus automatically and continually supplied with metal because of the constant level in the reservoir. Holding pots from which metal is supplied to the hot chamber machines are located and serviced in a central melt room rather than immediately adjacent to the machines. It is expected that much of the production from the hot chamber machines will go into the automotive industries.

Delpark Puts Cooling Savings in Dollars

In a recently released brochure, Delpark gave the case history of the savings obtained at Continental Motors by the use of Delpark filters. It broke down the savings into five categories based on the servicing of 165 machines in the Continental plant. The savings effected are as follows:

Savings due to reduction and maintenance and labor	\$ 19,000
Savings on replacement parts	4,500
Savings on labor of cleaning tanks	145,000
Savings on coolants	71,000
Savings on grinding wheels and tools	50,000
Total gross savings per year	\$289,500

HPM Goes King Size

Hydraulic Press Manufacturing Co. has installed a 7000 ton press, said to be one of the world's largest, at the Douglas Aircraft Long Beach, California, Div. The press, which weighs well over a million pounds, will be used to form sheet metal parts by the Guerin process and by the Hidraw process. For the latter, pressures up to 10,000 psi will be utilized.

Machine Its Own Plant

The Minnesota Mining and Manufacturing Co., St. Paul, has come up with an automatic machine which is approximately three city blocks long and is in effect its own plant. Claimed to be the world's largest sandpaper maker, the 976-ft-long unit is actually a single manufacturing unit with a shell built around it. Electronic,

nucleonic, mechanical and air equipment in the machine control speeds, curing temperatures, bond viscosities and other variable factors. Radiation in the form of beta rays is used to measure uniformity of coating thickness and weights. A battery of recorders keeps a continuing check on the manufacturing process.

New Bullard Foundry for '55

According to E. C. Bullard, president, the Bullard Co., Bridgeport, Conn., the contract has been awarded for the construction of a new foundry. Cost of the building and equipment will run in the neighborhood of \$6 million. It will have the latest developments in dust and smoke control and materials handling equipment and, according to Bullard's president, will be the most modern gray iron foundry in New England. It will contain approximately 150,000 sq ft and will be completed by the end of 1955.

Cone Drive Gears for Giant Electric Furnace

Two Heroult furnaces, of 200 ton capacity, said to be the world's largest, are going into service at the Trenton, Mich., plant of McLouth

Steel Corp. Each unit, built by the American Bridge Div. of U. S. Steel Corp., utilizes seven speed reducers, made by Cone-Drive Gears Div., Michigan Tool Co. One of these drives, a double-reduction, double-enveloping speed reducer with center distances of 10 and 21.837 in., is used to tilt the furnace and heat, which has a combined weight of 700 tons.

From Michigan Tool Co. we also learn that a complete gear production development laboratory has been established at the main plant. The purpose of the laboratory is to assist gear makers in producing smoother and quieter gears at lowest possible cost.

Package Press for Automation

Two and four point presses built by E. W. Bliss Co., Canton, Ohio, have been designed particularly for use with automatic materials handling devices so vital in today's high production economy. All wiring and piping are contained in the press uprights and the controls are housed in recessed panels on the upright. Portable power tools can be plugged in to built-in electric and air lines. Bliss claims that with the package press, practically all an installation crew has to do is plug it in.

Heat Treating Aircraft Engine Gears

(Continued from page 53)

plus one 25-in. press with a roller die attachment for shafts.

After quenching, the parts are placed in wire baskets on a mechanized conveyor that extends along one side of the heat treat department serving all three rotary hardening furnaces. The baskets are automatically moved to a hump or high point at the end of the power conveyor from where they travel by gravity to a washer and a Surface Combustion gas-fired convection heated draw furnace.

After the parts are washed they are heated to 300 F for the required time. This is followed by a light mechanical blast cleaning and copper plate stripping where required.

Close control of production to this final stage is facilitated by marking each part with part number, mill heat code, heat treat code, magnetic inspector's mark, backlash inspector's mark and materials review mark and number.

Producing Coaxial Power Steering Gear

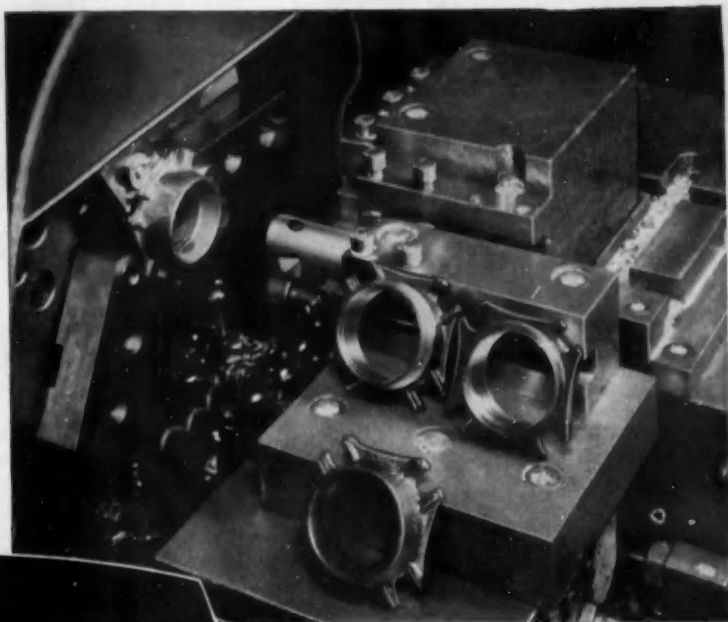
(Continued from page 58)

lapped on both side contacting faces in such fashion that the thickness of the first section is held to minus 0.0002, the next plus 0.0002 in., the next minus 0.0002 in., and the last one plus 0.0002 in. In effect, the overall spacing error on the rack must not exceed 0.0005 in.

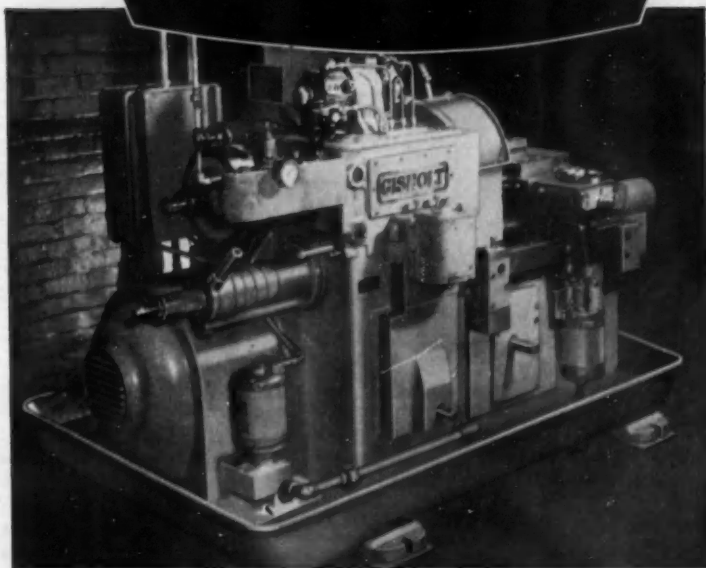
As illustrated, final assembly of power steering units is done in a large enclosed area, held to a stand-

ard temperature and under a slight positive air pressure. The objective is to afford assembly conditions in a standard temperature and with scrupulous cleanliness. Sub-assemblies are made up on suitable benches on each side of the two final assembly lines, checked 100 per cent before being cleared for assembly. The two power-driven assembly conveyors are each 120 ft in length.

Small Job Shop Catches the BIG IDEA



cuts costs with— GISHOLT No. 12 HYDRAULIC AUTOMATIC LATHE



No matter whether the shop is large or small . . . if there's volume, there's the opportunity to make money faster with automatic machining.

The Kilbourn Engineering Company of Milwaukee saw it—and proved it again—subcontracting these parts for electric hot water heaters with the Gisholt No. 12 Hydraulic.

Greater Production

With its fast automatic cycle and multiple cutting, the Gisholt turns out these parts at twice the rate of the previous method. A man merely loads and unloads the machine. The owner is not limited to this one job either. It is easily set up to handle a variety of work up to 12" in diameter.

Corner for Profit

Such work can be highly profitable for job shops. Especially when the whole operation can be tucked into one small corner of the shop as this one is.

Progressive thinking like this is what makes many small shops grow into big ones. Gisholt engineers can help you with all kinds of ideas for making the most of machine tools.

GISHOLT MACHINE COMPANY

Madison 10, Wisconsin

THE GISHOLT ROUND TABLE

represents the collective experience of specialists in the machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.



TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • SPECIAL MACHINES

NEW

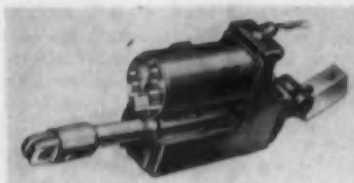


AIRCRAFT PRODUCTS

FOR ADDITIONAL INFORMATION, please use reply card on PAGE 89

Thin Actuator

Series 413 linear actuator is designed for thin control surfaces. Weight of the units varies from 1.7 lb to 2.4 lb depending upon output, stroke, and radio noise filter requirements. In both tension and compression



the actuator provides ultimate structural strength up to 2000 lb, maximum static strength up to 1300 lb, and operating output up to 500 lb. Envelope size of the largest actuator in the 413 series measures 1 1/2 in. by 3 1/2 in. with an overall retracted length of 7 1/2 in. Maximum stroke is three in. A radio noise filter is designed as an integral part of the unit to operate from a standard aircraft 26 v dc power supply.

With the newly-designed limit-switch system, more accurate positioning of stroke length is said to be possible. Once set, the positioning accuracy of the new actuator is retained within very close tolerances over a long period of time. A spring-loaded end fitting permits continuous pressure to be applied by the actuator at the completion of the retraction stroke. Electrical leads can be brought out the front, bottom, or either side of the actuator housing. *Lear, Inc.*

Circle 36 on postcard for more data

Small A-C Motors

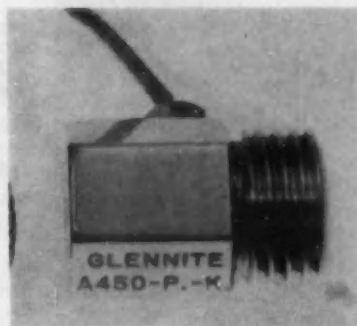
Type SC sub-miniature, 400 or 600 cycle ac motor is 1 1/16 in. in diameter. Protection for military environmental specifications has been considered in the design. It can be wound

for single phase, two phase or three phase, and can be furnished as an induction or hysteresis motor. The characteristics can be modified to cover a wide range of application requirements. The motor can also be furnished with a concentric spur gear reducer. For specific applications, details should be submitted to the factory for determination of the final design. *Globe Industries, Inc.*

Circle 37 on postcard for more data

Accelerometer

Said to be an extremely wide range barium titanate accelerometer, a modified version of a National Bureau of Standards design has just been announced under the designation of Glennite Perls-Kissinger Model A 450. Resonant frequency is 80 kc, and useful frequency range is 10 to 25,000 c. Sensitivity is 0.75 mv/g, with a capacitance of 800 mmf with 3 ft. of low-noise cable. Maximum sensi-



tivity is perpendicular to the mounting, and lateral sensitivity is less than 15 per cent.

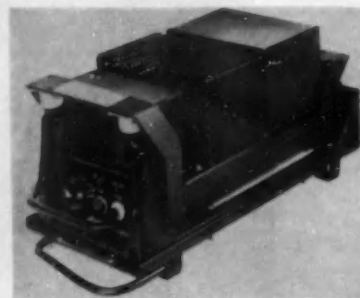
Temperature range is less than plus or minus 10 per cent variation in sensitivity from -40 C to 90 C, and acceleration range measures from 1 g to $\pm 30,000$ g. Size of the unit is 1/2 in. hex by 13/16 in. long. *Gulton Mfg. Corp.*

Circle 38 on postcard for more data

Control Panels

A-c control panels which meet military specifications are designed to be readily tailored to the electric system of any aircraft. Four basic panels facilitate selection.

Two panels are for use where d-c is



available for control power. One of these panels is for single-generator systems (isolated); the other is for multi-generator systems (parallel). Both panels are designed to operate even if the supply of d-c should fail. The other two basic panels are for operation where d-c is not available for control power. One of these panels is for isolated systems; the other, for parallel systems.

These panels incorporate protective and control elements applicable to the particular systems. Elements include: differential current fault protection; underspeed protection; phase sequence protection; open phase protection; generator control relay with an anti-cycling device; overvoltage protection; overvoltage lockout; undervoltage relay; over and underexcitation protection; field flashing; power indication; off frequency protection; transformer-rectifier unit; remote trip; regulator; and electric and/or manual reset. The overvoltage sensing tube, thermal device temperature compensated, has been designed to be insensitive to acceleration forces. *Jack & Heintz, Inc.*

Circle 39 on postcard for more data

more cars and trucks



are factory-equipped

with

FRAM



than any other make

**OVER 150 LEADING MANUFACTURERS SPECIFY
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Year after year, FRAM leads the industry in design, development and production of finer filtration systems. This FRAM leadership can help solve your problem in oil, air, fuel or water filtration. FRAM engineering facilities, including the FRAM Dust Tunnel at Dexter, Michigan, are at your disposal.

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OIL • AIR • FUEL • WATER
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METALS

Deliveries of Cold Rolled Steel Sheets Lag Behind Orders by Six to 12 Weeks. Domestic Producers Raise Price of Aluminum.

By W. F. Boericke

Fast Pace for Steel

After the Christmas holidays steel production rose sharply to start the new year with an 82 per cent production rate—it had averaged 71 per cent in 1954—and almost unlimited optimism, in sharp contrast with sentiment a year ago. Estimates for 1955 output range from 95 to 112 million tons of raw steel. Most industry leaders forecast 10 per cent larger output than the 88.3 million tons poured in 1954.

All agree that the inventory situation has been infinitely improved compared with a year ago. This means that steel production and consumption will be more closely related than in 1954, when consumption exceeded output by about 7 million tons, all of which represented inventory reduction. Thus 1955 production would have to increase by this amount just to meet demand at the 1954 level.

Cold rolled sheets, the industry's largest tonnage item, are in strongest demand. Promises of delivery are normally six to seven weeks after receipt of order, but now it's often a matter of 10-12 weeks. So tight is the supply that a number of mills are allocating these products to make sure their regular customers are served. This means that the occasional buyer doesn't have a chance for fast delivery. According to *The Iron Age*, the steel gray market is back for cold rolled sheets and galvanized sheets, with the same old story of desperate consumers willing to pay a premium price to get what they want.

Railroad Buying

Indication of a pick-up in long quiescent rail business for steel mills was seen in a recent order for 22.7 miles of heavy duty rail for replacement use in main-line tracks by the D.L.&W.R.R. Most of this new rail will weigh 132 lb to the yard. There are recurrent reports that railroad requirements are likely to expand. This can't be delayed much longer for steel buying by the railroads has been almost negligible during the last year. Orders for car repair parts also show definite improvement. Steel makers likewise are confident of doing more business for manufacturers of material-handling equipment, who will be big beneficiaries of expanded highway construction programs.

Export Business

The outlook for foreign business in steel is good.

German rearmament is likely to make West Germany steel less of a competitive factor in markets that normally look to American mills. While German mills have been running to capacity, orders have been piling up faster than deliveries can be made and delivery dates are six to nine months ahead. Instead of exporting steel, German imports may increase. American steel mills can confidently expect to supply South American countries that placed considerable tonnage with Continental steel producers in 1954.

Can Copper Price Be Held?

Copper demand continues far in excess of supply. Without doubt the domestic price of 30 cents per lb could easily have been advanced during the last month to a level more in line with the London price of 37-38 cents if the big producers had not stubbornly resisted it in spite of tremendous pressure.

Their reluctance to advance the price was inspired by their belief that the best interests of their industry would be promoted by a stabilized price which would make it less vulnerable to inroads into their markets by competitive aluminum. The belief is also widespread that by the end of the first quarter the strike-inspired pinch in copper supply should be measurably eased by increased production from new domestic mines. In any event this is almost certain to occur in the second quarter, barring some unpredictable emergency.

Yet by mid-January it was anyone's guess whether the 30 cent price could be held. The strike of the native workers in Northern Rhodesia cut off about 35,000 tons of copper per month from world supply. This had caused a pinch in cash copper in London and on the Continent with prices advancing daily as speculators sought to cover. It was also reported that Chile would divert some of its 30,000 tons from the United States to Europe to take advantage of the higher market.

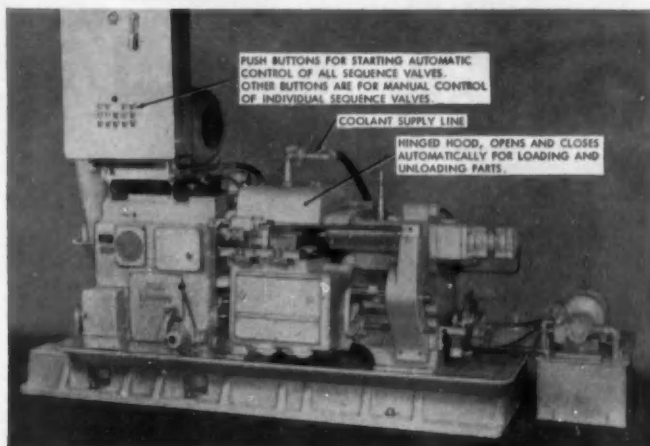
Publication of the December figures by the Copper Institute gave small cause for comfort. Deliveries of refined copper in December totaled 119,600 tons, the highest level of the year. Crude production was 85,500 tons and stocks at the end of the year were only 47,100 tons, scarcely 12 days' supply at the December rate of shipment. Thus a deficit of some 34,000 tons existed between domestic production and deliveries to users, which is normally made up by imports. If these foreign supplies were switched to Europe because of a better market there, a higher price here would be inevitable.

(Turn to page 108, please)

MACHINE OF THE MONTH

PREPARED BY THE SENECA FALLS MACHINE CO. "THE Lo-swing PEOPLE" SENECA FALLS, NEW YORK

Hinged hood in open position for loading and unloading parts ▶



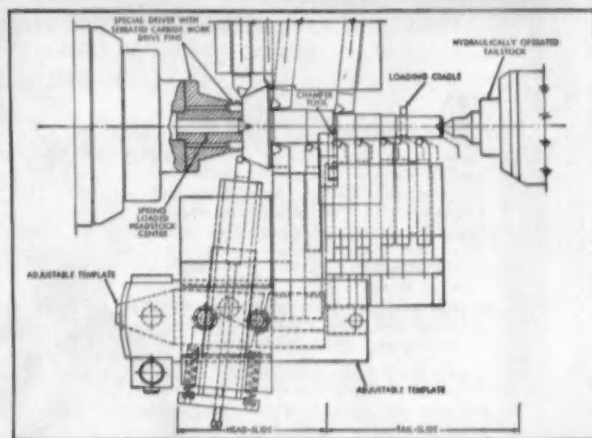
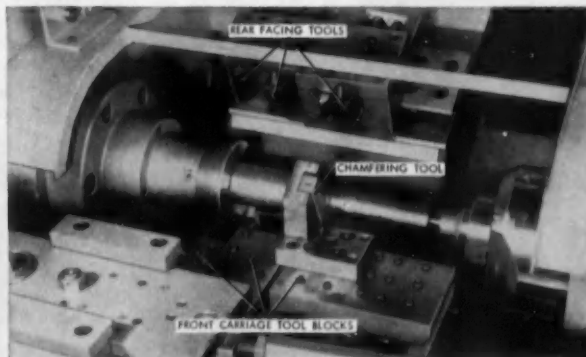
Lo-swing LATHE CUTS MACHINING AND HANDLING TIME ON REAR AXLE DRIVE PINIONS

PROBLEM: To finish turn (from end to end) Rear Axle Drive Pinions in one operation and to reduce handling time to a strict minimum.

SOLUTION: A Model AR Automatic Lo-swing Lathe, equipped with Automatic Controls and Serrated Pin Type Driver was selected for this job. The work piece is driven from the gear end by a special driver fitted with serrated carbide pins which indent the large face of the gear. Indentation is obtained by pressure from the tailstock center which is mounted in a hydraulically operated quill. Two pressures, automatically controlled, are used... a high pressure for forming the indent while the shaft is being loaded between centers and a low pressure during the actual machining operation.

This method of driving the work piece permits the machining of all of the gear and stem diameters as well as the facing and undercutting of shoulders in a single operation. Eight carbide front turning tools, one of which is template operated, reduces the length of cut to 2-3/16". This is the length of cut required for the bearing nearest to the bevel gear. The facing, undercutting and chamfering of shoulders are accomplished with four carbide tools mounted on the rear slide. It should be noted that the template is adjustable to handle bevel gears having different angles.

Handling time and operator fatigue are held to a strict minimum by the use of a loading cradle and auto-



matic controls for placing the part between centers, and opening and closing the hinged hood.

The machine stops at the end of the cycle with the spindle stopped, tailstock center retracted, hinged hood open and with the machined part dropped into the cradle. The operator simply replaces the finished part with a rough forging and then pushes two starting buttons, energizing the loader controls, which consecutively close the hood, place the work between centers, indent for the driver pins and finally start spindle rotation. The automatic cycle from then on is controlled by the automatic camming built into the base machine.

The tooling area of the machine is entirely enclosed to protect the operator from flying chips and coolant while cutting at high spindle speeds. Two starting buttons, wired in series, require the operator to use both hands. They are so located that the operator is out of range of the closing hood, thereby preventing accidents.

Control buttons on the door of the starter panel permit normal operation of individual controls and are convenient for setting up and timing loader movements.

Seneca Falls engineering staff is at your disposal to help solve your production problems.

SENECA FALLS MACHINE CO., SENECA FALLS, N. Y.

PRODUCTION COSTS ARE LOWER WITH Lo-swing

MAKING TORSION BARS for New Passenger Car Suspension

(Continued from page 84)

And that is precisely what has taken place. As will be noted later, the basic know-how of this organization has made it possible to produce torsion bars in exceedingly simple fashion.

The pairs of bars differ in length due to differences in wheelbase of the models. The long suspension bars are

approximately nine feet in length; while the compensator bars are approximately four feet long. The long bars are about one-inch in diameter, the short bars slightly smaller.

Secret of the process at this writing is in the use of SAE 5160, chrome-manganese steel, purchased precision-rolled to extremely close tol-

erances and employing control of decarburization. Although this specification carries a high price tag from the standpoint of raw materials cost, it has an enormous effect upon reducing overall manufacturing cost by eliminating all subsequent machining operations.

Except for a few additional items of equipment, to be mentioned later, Maremont is utilizing the major items of equipment described in the earlier article. On the other hand, higher volume has made it economical to install automation at the various operations, thus contributing to lower cost and increased productivity. Automation was not entirely in place when the accompanying photographs were taken.

The following description of the major steps in producing long bars will stress the simplicity of the set-up:

1. Abrasive wheel cut-off of bars to length.
2. Heating one end at a time in an open end furnace ahead of upsetting.
3. Upsetting the hexagon-shaped end, one end at a time, in a Hill-Acme unit.
4. Restrike of hex end in a mechanical press.
5. After both ends have been completed, the bars are transferred to the hardening furnace.
6. From the hardening furnace the bars move immediately into an adjacent Gogan quenching machine for oil quenching, being held securely in the fixture to prevent distortion. The machine is large enough to accommodate two long bars or four short bars at a time.
7. Following quenching, the bars are transferred to a draw furnace for a specified cycle.
8. Next is shot-peening in an automatic Wheelabrator which shot peens all over.
9. The work is transferred to the bar conveyor of an adjacent dip tank in which the bars are coated with a Zincilate formulation and baked before leaving the unit. The only function of this treatment is to provide a corrosion-resistant finish.
10. Final operation, before shipment, is the presetting of each of the long bars, coding them in rights and lefts. This is done in a special twisting machine designed and built by Maremont for this job. Presetting is an extremely fussy operation since the alignment of both ends must be held within plus or minus one degree, in a twist angle of over 200 deg.

Presetting is done only on the long

(Turn to page 102, please)

Highest Precision HARDENED & GROUND PARTS

THE ball stud shown here is a perfect example of the precision methods and quality material that go into the production of all Brown Hardened and Ground Parts. Twelve separate operations are employed to produce this vital part. Every feature about this ball stud has to be right—every feature is. It has strength, wear resistance, precision fit, true-ground spherical and tapered surfaces, close inspection and strict uniformity.

Brown Hardened and Ground Parts have been serving the automotive industry for over 40 years. We refer you to any of our long list of satisfied customers. For information pertaining to your own requirements, simply write or wire.

Henry W. Brown
PRESIDENT



Parts Include
King Pins
Shackle Bolts
Shackle Pins
Brake Anchor Bolts
Countershafts
Idler Shafts
Stub Axle Shafts
Steering Ball Bolts
Beam Bolts and Bolts
5th Wheel Rocker Shafts
Wheel Studs
Water Pump Shafts
anything in the
hardened and ground
line, of any analysis
steel, up to 4 1/4" diameter.

THE BROWN CORP.

213 BELLEVUE AVE.

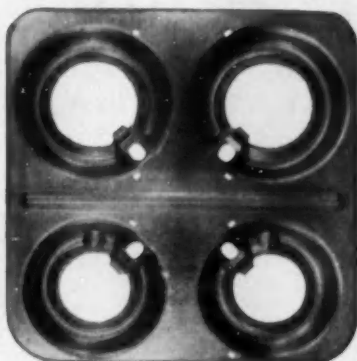
SYRACUSE, N. Y.

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For Dies... Drill, Welding, and Assembly Jigs



Vulcan, keeping pace with modern tooling, can recommend plastic tooling for medium production on numerous tool programs.

Plastic tools are light in weight, have good impact, compressive strength and dimensional stability. No hand finishing of parts required as galling or marking is eliminated by using plastic form dies.

Contours and odd shapes are cast or laminated to suit individual tools, saving expensive machine and hand finishing operations.

Plastic tools, built in a matter of days instead of weeks, lower your tool costs for those medium production runs.

Our actual production figures prove plastic has a definite place in modern production.

Vulcan Tool Company's organization, building fine tools since 1916, believes new tooling developments must be proved by tool engineers. Since plastic is not a cure-all your problem should be handled by recognized, practical tool men.

Our engineering staff will recommend the correct plastic material and advise if parts of your tooling program should be in plastic.

Send a part print and your production requirements for quotation and recommendations.

Major Vulcan Services . . . Engineering, Processing, Designing and Building . . . Special Tools . . . Dies . . . Special Machines . . . Vulcamatic Transfer Machines . . . Automation . . . including the Vulcan Hydraulics that Form, Pierce, Assemble and size. Vulcaire Jig Grinders . . . Motorized Rotary Tables . . . Plastic Tooling.

VULCAN TOOL CO....PLASTIC TOOL DIVISION

743 Lorain Ave., Dayton 10, Ohio

AUTOMOTIVE INDUSTRIES, February 1, 1955

...a new concept of the.....

Since 1914 Bullard Mult-Au-Matics have been
widely used in many industries requiring high
production of parts with repetitive accuracy.

The Mult-Au-Matic Type "L" incorporates many new developments.

... Here are some of them ...

★ **CONTROL SYSTEM**

All functions of the machine are controlled from conveniently located push buttons with minimum operator effort and maximum safety.

★ **FEED MECHANISM**

Completely new screw type feed works provide a 16" stroke with 81 feed changes ranging from .0025 to .0625.

★ **SELECTIVE SPINDLE SPEEDS**

At each station, speed range from 35 rpm to 1,000 rpm allows selection of correct cutting speed to suit operation at each station.

★ **CARRIER INDEX**

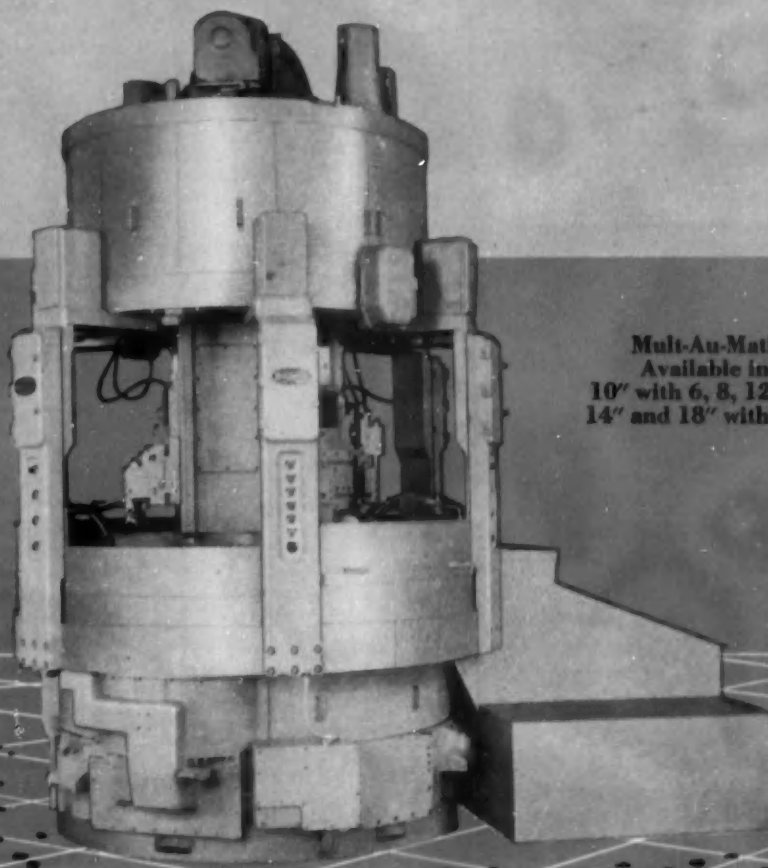
New mechanism permits faster indexing of carrier which saves time between cuts.

★ **OPTIONAL EQUIPMENT**

Includes multi-purpose heads, drill heads, tapping heads, precision boring heads, automatic loading and gauging equipment and chip removal conveyors.



BULLARD MULT-AU-MATIC



Multi-Au-Matic Type "L"
Available in three sizes
10" with 6, 8, 12 or 16 spindles,
14" and 18" with 6 or 8 spindles.



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THE BULLARD COMPANY

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NEW MULT-AU-MATIC TYPE "L" CATALOG

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BLC

Are you one of a select group of aerodynamicists sincerely interested in boundary layer control projects? The Aircraft Division of Fairchild offers a genuine creative opportunity to such men.

Fairchild has been intensively engaged in boundary layer control studies since 1951. In addition to building up its own staff of engineers specializing in boundary layer control, the company has contracts in effect with Mississippi State University and leading authorities in boundary layer control at Princeton and the University of Wichita. Recently, Fairchild appropriated more than a million dollars of company funds for an accelerated program of boundary layer control.

Gracious country living only minutes away from urban Baltimore or Washington . . . paid pension plan . . . an excellent salary with paid vacations . . . an ideal working environment . . . generous health, hospitalization and life insurance . . . and the many other benefits of a progressive company add to the pleasure of working with Fairchild.

You'll be investing wisely in a secure future if you take time today to write to Walter Tydon, Chief Engineer, outlining your qualifications. Your correspondence will be kept in complete confidence, of course.



BOUNDARY LAYER CONTROL



ENGINE AND AIRPLANE CORPORATION
FAIRCHILD
Aircraft Division
 HAGERSTOWN, MARYLAND

Making Torsion Bars

(Continued from page 98)

bars since the compensator bars must operate in both directions. We mentioned earlier that no machining is required. The only exception is the case of the compensator bars. One end of each compensator bar is upset with a hex as well as a stub end extending beyond the hex. Later the stub end is ground to size from the rough in one of the Cincinnati Centerless grinders.

We referred earlier to the installation of automation now in progress. It is rather simple in nature, primarily designed to mechanize handling and transportation. For example, there is a conveyor chain running the length of the heating furnace, carrying heated bars to the Hill-Acme upsetter at the end of the line. Then there is a short length of chain conveyor for transporting bars from the upsetter to the coining press nearby. Similarly, another long chain conveyor extends from the press to the heating furnace for heating the other end of the bar.

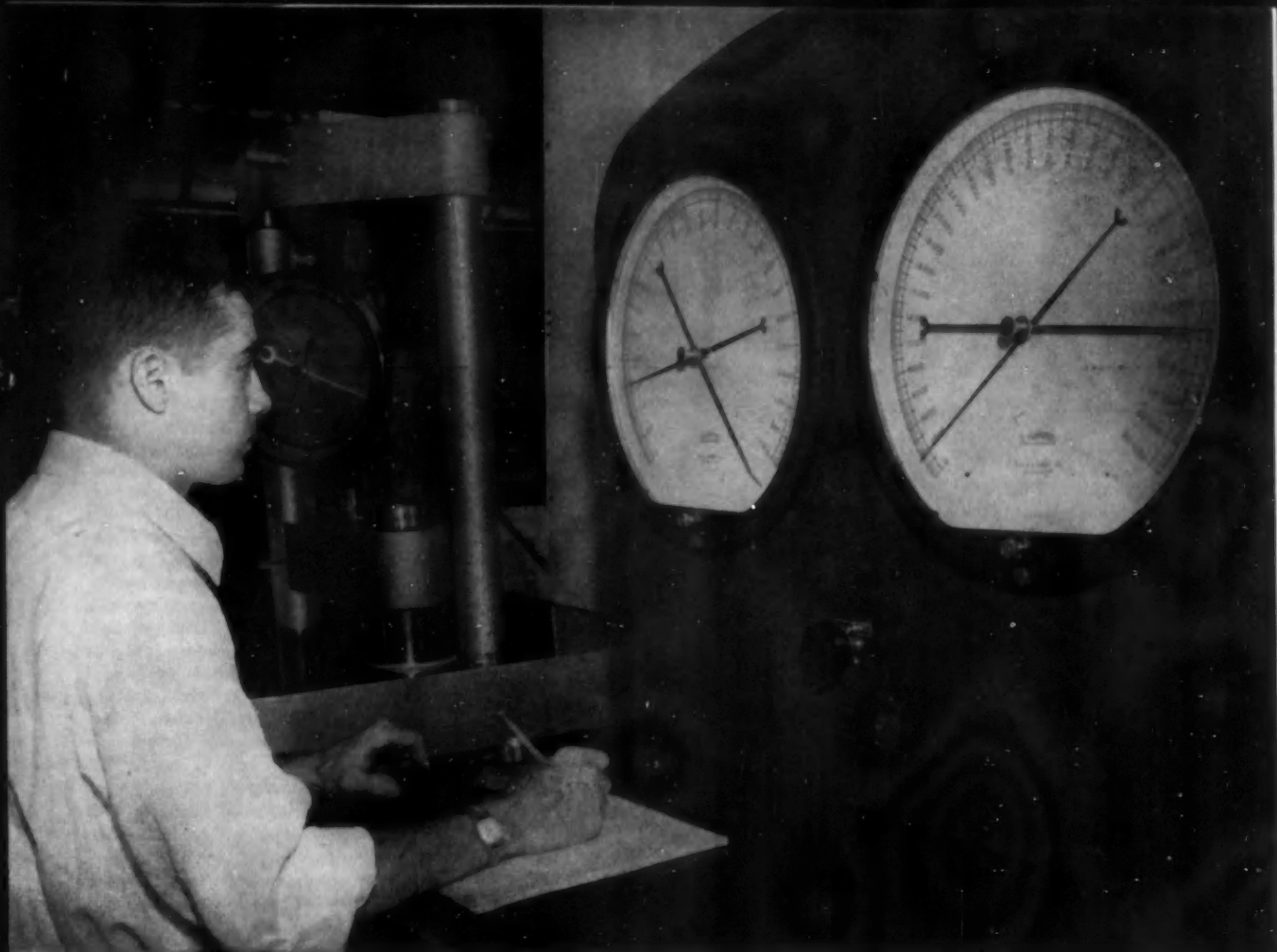
The dip tank and bake oven installation is new, completely automatic in action, and installed directly between the Wheelabrator shot peening machine and the new twisting machine. Thus the movement of work from one operation to another in this area is quite short, contributing still further to production economy.

When bars reach the hardening furnace, immediately after leaving the upsetting operations, they are fed to the furnace on a conveyor, and moved through the furnace with screw conveyors. Similarly, the Gogan quenching machine is installed directly at the exit end of the hardening furnace, making it a simple matter to feed the bars to quench on a conveyor.

A sampling of illustrations taken here will show the reader the simplicity of the set-up as well as the economy of movement from one operation to another because of the compactness of the entire layout.

In fact, the entire cycle of operations is a tribute to specialized know-how in this field, laying the groundwork for still further development in handling economically the larger volume of torsion bars that may be anticipated in the future.

AUTOMOTIVE INDUSTRIES
Keeps You Informed



Baldwin's low-cost 60-H makes testing easy for the University of Pittsburgh

For testing parts of naval aircraft the University of Pittsburgh's Engineering Research Division uses the Baldwin 60-H. Also secondary load measuring devices such as dial type dynamometers and tension bars with SR-4 strain gages are calibrated by this testing machine.

Pitt chose the Model 60-H for testing economy and simplicity. And they've found this low-priced, easy to operate machine enables engineering students to do most of the test work. Its convenient control system, many automatic safety features and simple maintenance make testing at Pitt an easy and trouble-free operation.

The Baldwin Model 60-H gives the University of Pittsburgh *all* these testing benefits.

1. Simple operation makes it easy for engineering students to do test work.

2. The machine meets *all* requirements at low cost.

3. Accuracy of load measurements is well within laboratory requirements.

4. Separate frames for loading structure and indicator prevent transmission of shock when test specimens break.

5. Scale ranges of 0-12,000 lbs. and 0-60,000 lbs. are exactly suited to stress ranges of the test work.

Like the University of Pittsburgh, you can have *all* these benefits with the Baldwin Model 60-H. You'll learn that Baldwin designs testing machines to give outstanding performance. For more information about the Baldwin Model 60-H and other testing equipment, write now to Dept. 2504, Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa.

TESTING



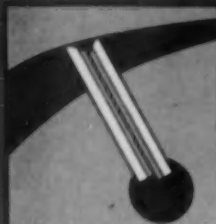
HEADQUARTERS

BALDWIN - LIMA - HAMILTON

General Offices: Philadelphia 42, Pa. • Offices in Principal Cities

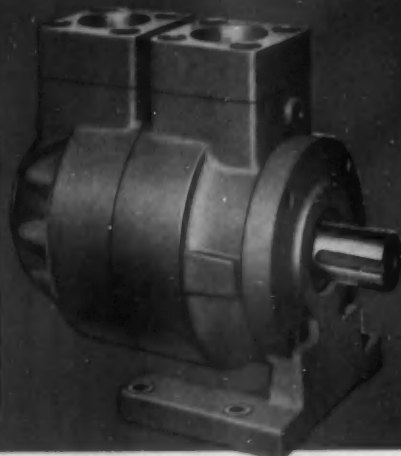
In Canada: Peacock Bros., Ltd., Montreal, Quebec

Brute Strength or Delicate Handling of Rotary Power Functions . . .



TWO VANES ARE BETTER THAN ONE

The hydraulically balanced DUDCO DUAL-VANE Fluid Motors, as contrasted with conventional designs, maintain MULTIPLE AREAS OF CONTACT ON THE CAM RING . . . doubling the number of effective barriers to slippage and power loss. This patented principle is an exclusive DUDCO feature!



DUDCO FLUID MOTORS

Compact and sturdy, DUDCO DUAL-VANE Fluid Motors operate quietly and smoothly under the most strenuous conditions. They're built to "take it" . . . frequent reversals, rapid accelerations or stalling under load. With DUDCO you get the big advantage of 2000 psi operation at a cost comparable with that of lower pressure equipment.

DUDCO is a big, exciting story for every hydraulics engineer because . . . power losses are minimized and operating efficiency is higher . . . starting torques are high . . . operation is smooth, quiet and exceptionally free from wear or maintenance problems.



On Conveyor systems for agricultural, feed processing, mining and other industries, DUDCO DUAL-VANE Fluid Motors provide the extras in performance that save time, money and labor. Operating



the winches on a giant tank retriever and other large mobile equipment calls for high starting torque and the dependable power of DUDCO DUAL-VANE MOTORS.

Write for Bulletin DM-301 fully describing
DUDCO DUAL-VANE Fluid Motors today!

DUDCO DIVISION
THE NEW YORK AIR BRAKE COMPANY
1705 EAST NINE MILE ROAD * HAZEL PARK * MICH.



New Highs Established in Horsepower and Torque

(Continued from page 49)

for bhp/cu in. Table 2, on the other hand, rates the same engines in a descending order of values for torque/cu in. At the same time columns 1 and 2, respectively, show the relative ranking of each engine with respect to both criteria.

This year also marks a major swing to 12-volt electrical systems. All cars in the GM family have 12-volt equipment, a mighty sweet song for the Delco-Remy division as well as for the lamp makers. Among independents, Packard and models of American Motors using V-8's also have joined the fold. For the first time since the introduction of 12-volt systems, the equipment builders will be able to enjoy the fruits of mass production with its incident effect upon manufacturing and distribution costs.

While on the subject of high horsepower ratings, it is only fair to note that many of these ratings are given at engine speeds far beyond the normal operating range on the highway. They can be approached only in gear, can be usable only for extremely high acceleration rates.

With the advertising value of horsepower placed so highly, it is well to observe the concern of engineers prominent in this picture. Advertised ratings are hardly comparable under present conditions and will remain "paper" values until everyone adopts a uniform formula for what it is that constitutes a "bare" engine and until there is a uniform engine test code.

From a design standpoint the new crop of V-8's has many distinguishing characteristics. One common characteristic is extremely short stroke, all designers aiming for minimum friction. As a result the bore/stroke ratio is uniformly oversquare. In fact, only the Chrysler Windsor is square; the rest range from a minimum of 1.05 to 1, to 1.27 to 1 in the case of the Studebaker Commander which has a stroke of but 2 13/16 in. This has resulted in compactness of structure, greater lightness, and improved mechanical efficiency as well as durability.

Moreover, designers have striven for individuality insofar as practicable. Consider combustion chamber design. Chrysler initiated and is continuing the distinctive hemispherical

chamber design on its larger engines. This stemmed from the adoption of twin rocker arm shafts for each bank. For 1955, however, Chrysler Corp. has some new engines—Plymouth for one—with only a single rocker arm shaft, producing a greatly modified form of combustion chamber.

Quite dramatically, both Chevrolet and Pontiac have come up with a valve train that eliminates the rocker arm shaft entirely.

Buick has achieved distinctiveness through the disposition of valves in the vertical plane. This form of layout reduces engine width, thereby increasing compactness, permits development of a unique combustion chamber, claimed to have still greater turbulence.

Packard has set its sights in another direction. Anticipating the need for larger displacement during the life of engine tooling, the block has been made deliberately longer to provide for greater spacing of cylinder bores. Thus Packard can effect large increases in displacement over the intervening years without scrapping basic pattern equipment or tooling, without penalizing the larger bore engine with respect to water jacketing.

Inevitably pistons and piston rings remain in a state of flux. True, all pistons are of aluminum alloy, all have three rings above the wrist pin. However, the basic design of piston structure varies considerably among makes. Most pistons are of slipper type, some full skirt. All have some form of expansion control.

Piston ring setups show considerable variation, too. Some makes have shifted to the rail type steel compression ring; most makes employ hard chrome plating for the top ring. More recently, M-P-R introduced its sintered metal ring which, doubtless, will be subjected to considerable testing in the industry.

Compression ratios are inching upward year by year, several General Motors engines being stepped up to 9 to 1. A large group of engines, as indicated in the tabulation are rated at 8.5 to 1. Despite this, a large percentage of engines have compression ratio of 7.6 to 1, the lowest this year being 7.5 to 1. Most designers anticipate an upward trend in compression ratio due to the cooperation of the petroleum industry in improving fuel quality and boosting octane ratings step by step.

Another significant design detail is the swing on the part of a number of manufacturers, Ford Motor Co. being notable among these, to the elimination of the conventional replaceable



These famous Gear Type Motors operate with pressures up to 1500 psi. Available in flange or foot-mounted models, in a complete range of sizes to 52 hp. They feature the exclusive HYDRECO Four Bolt design which places greatest strength in the area of greatest pressure.

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You find the answers to so many problems in the wide experience of HYDRECO engineers... especially where a function involves rotary motion. Powering the sweeper or the snow blower on municipal equipment, driving conveyor belts on trenchers, or shaking walnuts out of the trees at harvest time... these are but a few of hundreds of money-saving operations HYDRECO Fluid Motors are called upon to perform.

HYDRECO Fluid Motors, with their high starting torque, instant reversibility, and capacity for handling rugged and seemingly impossible assignments, are the natural choice of design engineers. HYDRECO dependability stems from the fundamentally sound "Pressure-Balanced" design, unmatched craftsmanship and the "know-how" of thousands of outstanding hydraulic applications.

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HYDRECO Hydraulic Pumps, Motors,
Valves and Cylinders today!

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THE NEW YORK AIR BRAKE COMPANY
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valve guide. Instead, the valve stem operates within a hole bored directly in the parent metal of the head. Obviously, this increases thermal con-

ductivity enormously. It is claimed that valve temperatures are reduced as much as 200 F at the head of exhaust valves.

Continuous Plating of Bumpers

(Continued from page 67)

ulation—1½ min.

22. Nickel strike—one cell tank, continuous circulation through heat exchangers, equipped with nickel purification—1½ min.

23. Drain and transfer—one cell space—½ min.

24. Nickel plate—two—eight cell tanks, 24,000 gal each, using Udyllite bright nickel processes, 50 ft long,

continuous circulation through filters and heat exchangers with two electro-purification tanks, using 40,000 amp at nine volts—0-30 min. per tank.

25. Drain and transfer—one cell space—½ min.

26. Recovery rinse—one cell tank—1½ min.

27. Cold water rinse—one cell tank, continuous circulation—1½ min.

28. Cold water rinse—one cell tank, continuous circulation—1½ min.

29. Acid dip—one cell tank, continuous circulation using 20 gpm Durichlor pump—1½ min.

30. Cold water rinse—one cell tank, continuous circulation—1½ min.

31. Warm water rinse—one cell tank, equipped with Platecoils—1½ min.

32. Chromium plate—two cell tank, Koroseal lined with brick bottom. Continuous circulation through heat exchangers, two Durichlor pumps with one standby—using 20,000 amp at 12 v—1½ min.

33. Recovery rinse—one station—1½ min.

34. Cold water rinse—one cell tank, continuous circulation—1½ min.

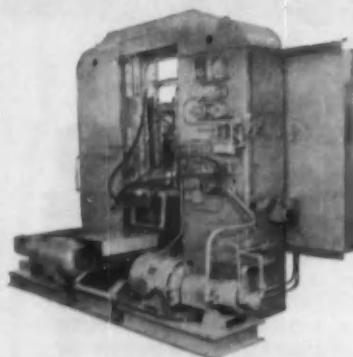
35. Cold water rinse—one cell tank, continuous circulation—1½ min.

36. Hot water rinse—one cell tank with Platecoils, air agitation—1½ min.

37. Hot air blow off—two station tank, movement in down position with blower and air coils—1½ min.

Racks emerging from the 37th station are picked up and transferred to the Cleveland Tramrail system. Bumpers are unloaded and conveyed to the assembly area while the Tramrail system carries the racks through a stripping operation and then back to the storage area.

ANOTHER *American* FIRST COMBINED BROACHING and CENTER DRILLING



Here, in one machine, American has combined two operations — broaching and center drilling of both ends of automotive main transmission shaft forgings, two at a time.

Two standard vertical hydraulic broaching machines were adapted to a common center table that is equipped with a hydraulically operated slide and two-station clamping fixture. Parts are automatically clamped in place, shuttled into the broaching and drilling positions, and unclamped — with the entire cycle being inter-locked with electrical controls.

American engineers will be happy to recommend the broaching equipment, either special or standard, that is best for your operation. Send sample part or detailed drawing. Your requirements will get prompt attention.

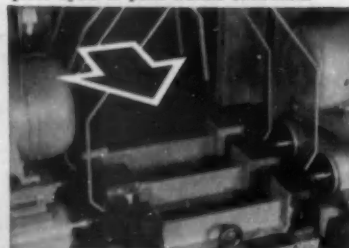


PRODUCTION:
Over 300 transmission
shafts per hour



Two parts are automatically clamped and shuttled into broaching position by hydraulic slide. Surface broach sections mounted on the two rams move down to broach approximately ¼" of stock from each end of forged parts.

While the rams return, the slide moves back, positioning parts for center drilling of both ends. Drills move in, after which parts are automatically unclamped. Complete cycle is push button controlled.



Write for Catalog No. 450, American's revised informative manual of broaching machines, broaches and fixtures.

AMERICAN
American BROACH & MACHINE CO.
A DIVISION OF SUNSTRAND MACHINE TOOL CO.

ANN ARBOR, MICHIGAN

See *American First* — for the Best in Broaching Tools, Broaching Machines, Special Machinery



BOOKS...

MAN, MOTIVES, AND MONEY, by Albert Lauterbach, published by Cornell University Press, Ithaca, N. Y. Price, \$5.00. The motivations of human behavior in all fields are complex and variable, and this is true also in the economic sphere. In the past, however, economists have assumed a simplicity and rigidity to man's behavior in economic situations that has led to the formulation of dubious laws of economic behavior in general. This critical and intelligent discussion of economic psychology should pave the way for further detailed and systematic research into this crucial field of study. It is not, as the author points out, until much factual research has been done over a long period of time that anything approaching a definitive theory of economic psychology can be formulated. On the basis of the factual data now available, however, and the examination of a quantity of economic, sociological, and anthropological literature, the author has formulated some challenging hypotheses that are worthy of consideration.

these thread rolling production pictures*

would look good
in any shop!

Report from Plant #1

*"This shop has been rolling
3/8"-16 threads continuously
for two months - at
2000 rpm. Still on
first set of rolls.
350,000 pieces to date."*

**Taken from two recent
National Acme sales re-
ports. More information
on request.*

Report from Plant #2

*"Have three machines rolling
7/16"-20 threads on C-1114 steel studs -
'Close to a million' so far - and
rolls have not been turned
around.*"*

*(*Thread Rolls are reversible, having a
lead of 1 1/4 to 1 3/4 threads on both sides.)*

These two reports show that National Acme (Fette Patent) SELF-OPENING Thread Rolling Heads come mighty close to being the answer to a production engineer's prayer for a steady, day-in, day-out flow of threaded pieces into the pan.

And when you consider that these thread rolling heads give you better threads—with smoother, more wear resistant surfaces, and with no cratering at the

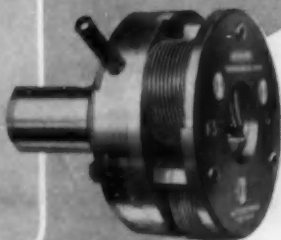
crest—aren't you missing a bet if you don't put them to the test on your threading jobs?

Wherever the work calls for threading machined parts from the end, there's no faster, better way than to "roll-em-on" with a National Acme (Fette) self opening head.

We'll be glad (and we think you will be too) if you ask us to prove that statement. Send sample or blueprint for our recommendation—or ask our representative to call.

May we send you a copy of Catalog PRH-53A?

National Acme (Fette) Thread Rolling Heads are used on automatics, turret or hand lathes, threading machines, drill presses — and other types of vertical or horizontal machines. Basically, they are SELF-OPENING heads which operate like a die head, except that threading rolls are used instead of chasers. And they OPERATE AT HIGH-SPEED-STEEL TURNING TOOL SPEEDS. Made in Revolving Type (capacities 7/16" to 1") and in Non-revolving Type (capacities 1/16" to 3/4").



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MARKEM**SOLVED THIS MARKING PROBLEM****IMPROVED PRODUCT APPEARANCE
— LOWER PRODUCTION COSTS**

A manufacturer of wood screws increased his product's retail merchandising appeal by changing from cardboard boxes to plastic tube containers which clearly display the screws. He now prints all label data directly on the cylindrical container with a Markem machine. Quickly changed variables in imprints include: quantity, type of plating, head type, length and size. Containers are imprinted as and when needed; no inventory of marked containers need be maintained. The method eliminated outside printing changes, tremendous paper label inventories, and labor of label application. One Markem machine, printing at production rates in exact quantities, has made possible the more attractive and appealing package and at the same time reduced production costs appreciably.

THE MARKEM METHOD CAN HELP YOU

This is just an example of how Markem solves industry's marking problems. The complete Markem Method consists of:

- (1) ANALYSIS of your marking or imprinting problems, (2) RECOMMENDATION of appropriate Markem Machine, Markem Type and Markem Ink, and (3) SERVICE — in installation, instruction, maintenance and supply.

If you want to mark products, parts or packages for identification, control or market, get in touch with Markem. The Markem Method has been providing a single source for savings in time, effort and inventory... since 1911.

Markem Machine Company, Keene 8, N. H., U.S.A.

MARKEM
... TO MAKE YOUR MARK

METALS

(Continued from page 96)

**Government Won't Divert
More Copper**

Following the strike at the copper mines and smelters last year the Government came to the help of consumers by permitting the diversion to them of some 45,000 tons of metal destined for the stockpile. This metal was to be returned to the Government before June 30 and prevented a really serious pinch from developing at that time.

However, it now appears that further diversion of Government copper to industry is unlikely. Only a small tonnage is currently being delivered to Washington. The stockpile could be tapped conceivably, but it would need an act of Congress and a Presidential order to do so, and no one expects that.

Aluminum Price Is Raised

By the middle of January the price of aluminum had been raised one cent per lb by the three domestic producers. The move was instituted by Reynolds, followed a few days later by Kaiser, and still later by Alcoa. It brought the price of pig to 21½ cents per lb and of ingots to 23.2 cents.

Effective January 1, Aluminum Ltd. had boosted the price of its aluminum ingot by ¼ cent to 19¼ cents per lb in Canada. The big Canadian producer, which accounts for a 25 per cent share of the free world's capacity, has scheduled a \$45 million smelter expansion of 60,000 tons at its Kitimat smelter which will bring its capacity to 151,500 tons by 1956. Because of its low cost of hydroelectric power, it will give Alcan the lowest production cost of aluminum in the world.

Aluminum producers assert the price advance was thoroughly justified by higher production costs. It is not expected that it will affect the soaring demand for the light metal. It is claimed today that demand for Canadian ingot exceeds supply, with strong U. S. buying and increasing British purchases. Some observers expect an aluminum shortage in 1955, in spite of assurances from producers that there will be plenty to go around. Many new uses are announced almost daily. Shipments of aluminum



How temperamental can a piece of steel be?

● Plenty! Because steel is one of the most *versatile* of all materials, it can play tricks on you . . . can be mighty temperamental, even obstinate. But, properly controlled, it works for you precisely the way you want it to!

For generations, National-Standard's Athenia Steel Division has specialized in the behavior engineering of high carbon steel for the most exacting services. Here, they've learned how to take the fullest *advantage* of steel's versatility. It

results in specially engineered, rigidly controlled steels that do a *better* job in all kinds of products from umbrella ribs and pen points to camera springs and piston rings.

Perhaps defense production brings you new problems in the application or behavior of steel. National-Standard and Athenia offer you the kind of engineering and development service that has speeded production and cut costs for many and many a manufacturer.



DIVISIONS OF NATIONAL-STANDARD CO.

ATHENIA STEEL..Clifton, N. J.....	Flat, High Carbon, Cold Rolled Spring Steel
NATIONAL-STANDARD..Niles, Mich.....	Tire Wire, Stainless, Fabricated Braids and Tape
REYNOLDS WIRE..Dixon, Illinois.....	Industrial Wire Cloth
WAGNER LITHO MACHINERY..Jersey City, N. J.....	Metal Decorating Equipment
WORCESTER WIRE WORKS..Worcester, Mass.....	Round and Shaped Steel Wire, Small Sizes



Mr. Raymond P. Scott
Oldsmobile
Wynnewood, Pa.

"I recommend

**Genuine
Leather**

because style counts for a lot

when you're selling Oldsmobiles."



"My customers take performance for granted when they're buying an Oldsmobile. What they are looking for is style and beauty. They get that—plus performance—when they choose one of the models upholstered in genuine leather. Leather is not only stronger, longer-lasting, and easier to care for—it is also the top of upholstery style."

Impartial tests back up what Mr. Scott says. Genuine leather upholstery is 77% stronger than the next-best upholstery material.

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Only genuine leather wears as well as it looks

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foil alone totaled 75,000 tons in 1954, up 30 per cent over 1953. Exports of secondary aluminum scrap add to the tight situation. Continental demand for aluminum has been insistent the last few months, where the price has been as much as four cents a pound above the domestic level.

Copper and zinc producers, with whom aluminum is competitive in several important lines, breathe easier as aluminum prices advance while their own have held stable.

Zinc Stocks Down; Smelter Output High

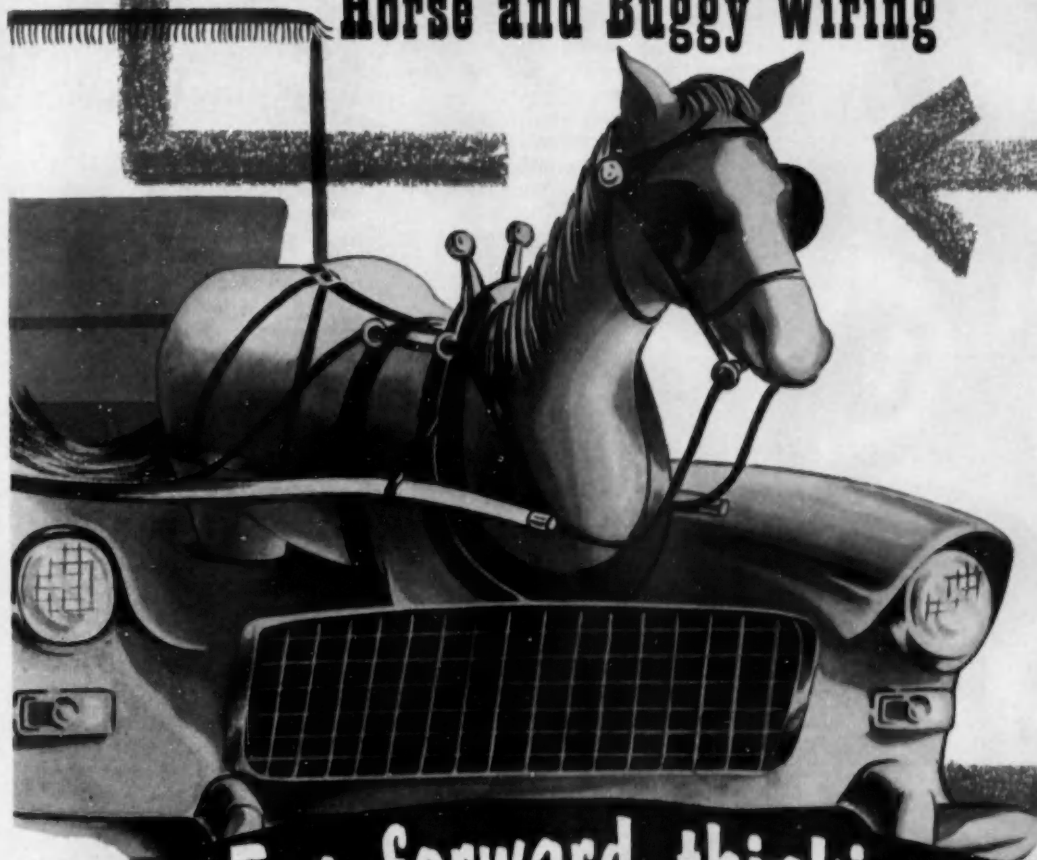
While year-end figures from the Zinc Institute showed another decline in stocks during December to 124,000 tons—a reduction of 85,800 tons from the peak of 209,800 tons reported seven months ago—ample zinc still appears available to satisfy all consumer needs without difficulty. No effort was made by producers to advance the price, which is considered unprofitable for domestic miners. Foreign zinc, which cannot be offered to the Government for stockpile purchase, has been available at concessions from the 11½ cent per lb official market.

There was considerable disappointment that smelter production in December continued at the record rate of 85,100 tons for the month with virtually no cutback from the high November output. Much has been said and promised that smelter production would be adjusted to bring it in line with lower mine output, but no tangible results are seen. It is thought that several plants speeded up operations to make up for output lost during the strike period, using concentrates accumulated at that time for the purpose. Smelter production in January may be lower as these excess concentrates are exhausted. Neither domestic mine output of zinc nor imports give reason to believe that smelter output can continue at its present rate.

Government Buying Supports Lead and Zinc

In spite of heavy deliveries to consumers it is likely that both lead and zinc would sell lower if it were not for Government purchases for the stockpile. But there is small likelihood that these purchases will decline. In fact, for zinc, if the Government is to achieve its objective of acquiring 300,000 tons by June 30, the buying rate must be sharply increased. And

Get Rid of Horse and Buggy Wiring



For forward thinking
in automotive wiring
consult

AMP

advantage of new wiring harness sub-assembly methods using AMP type Faston connectors with a resulting saving in time and cost.

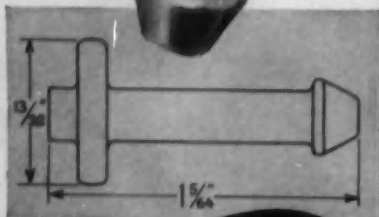
Integrated terminals and the machines to apply them form a precision engineered team that is faster in production, more reliable in the field and gives you all the added "plus" of AMP's Creative Approach to Better Wiring.

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AUTOMOTIVE INDUSTRIES, February 1, 1955



This cost:

SCREW MACHINE	\$14.00 per thousand
COLD HEADED	\$5.20 per thousand
SAVING	\$8.80 per thousand

How about your fasteners or small parts? Have you had an estimate from HASSALL?

This is a typical example of how HASSALL saves thousands of dollars for cost-conscious manufacturers in hundreds of industries. This part is made in one piece by cold heading . . . the part is not only lower in cost but also stronger and just as accurate. Savings amount to \$8.80 per thousand and this manufacturer used hundreds of thousands a year!

Perhaps your parts can be made by this better, lower cost method. Send samples or sketches of your parts for a prompt, \$\$\$ saving quotation.

- Send for 3 color decimal equivalent wall chart.
- On request, our 36-page catalog.



JOHN HASSALL, INC.

P. O. Box 2194 Westbury, Long Island, N. Y.

no one believes that Government support will end after that date.

Meanwhile, zinc producers are encouraged by the fast tempo of the steel industry, the high rate of automobile production, and the pick-up in business by the brass manufacturers. These factors call for more zinc by the principal customers — the galvanizers, the diecasters, and the brass makers in order.

Shipment of replacement batteries picked up in the fourth quarter. In November such shipments were 2,407,000 units compared with 2,173,000 in the same month of 1953, the first time the comparable month had been exceeded in 1954.



An automobile cooling system must circulate from 4000 to 10,000 gal of coolant an hour to carry off waste heat from the engine.

Since only one-third of the energy developed by a modern car engine is used to drive it, the other two-thirds is carried off as waste heat.

In 1953, based on the statistics from an average car, the automobile industry tailored 142 million square yards of cloth into new passenger cars alone.

The hydrogen blast set off at Eniwetok equalled at least one million tons of TNT; the atomic bomb dropped on Hiroshima equalled about 20,000 tons of TNT; the largest blockbuster of World War II equalled 10 tons of TNT.

It takes four years and costs more than \$500,000 to train the crew of a jet medium bomber.

The annual freight tonnage hauled by trucks amounts to 240 tons per family. Directly or indirectly, the average American family has a truck working for it approximately 58 days a year.



ON OUR WASHINGTON WIRE

The Administration is shifting emphasis in the budget for the fiscal year beginning next July 1 to building up aerial defense for all three branches of the Armed Forces and for research and development of guided missiles and advanced weapons. About two thirds of the military budget will be for airpower and related programs.

Rate of wear of a machine-tool bit is measured speedily and accurately with tracer radio-isotopes, a Government research study reveals. Results of tests are outlined in a 25-page publication, "Machining Studies by Radiometric Methods." Carrying the designation of Order PB 111473, it is sold for 75¢ by Office of Technical Services, U. S. Commerce Dept., Washington 25, D. C.

Applications for fast tax write-offs continue to reach the Office of Defense Mobilization at a rate of about 30 per week. While this rate of activity keeps alive the ODM program for encouragement of production facilities expansion, it does not solve the problem of generating enthusiasm for meeting Government goals in more than 80 fields.

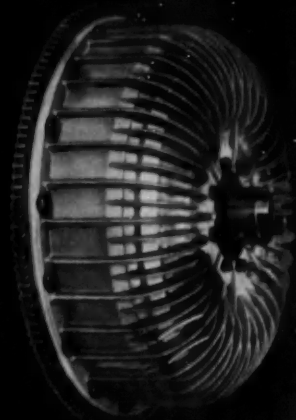
Another attempt is being made by one legislator to get Capitol Hill authorization for a Highway Finance Corp. The new resolution, H.J. Res. 113, much the same as one offered in 1954, would establish an agency to buy state and local government securities issued to pay for highways.

Congress will probably go along with President Eisenhower's request for a 20 per cent increase in the minimum wage—from the present 75 cents per hour to 90 cents per hour.



KEEPING PACE with the Horsepower Race

through
BORG-WARNER
Engineering...



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To carry the increased torque of such power-loaded engines is a giant-size job for clutches or torque converters. The big problem is to pack more "muscle" into these units without increasing their over-all dimensions.

Through advanced design and creative engineer-

ing, Borg-Warner's Borg & Beck Division has stepped up the capacity of its famous clutches and torque converters, while keeping within the size limits of the car manufacturers.

Compact, light in weight, precision built, these B-W Borg & Beck units transmit today's stepped-up horsepower smoothly, quietly, efficiently. They, too, carry on Borg-Warner's "design it better—make it better" tradition.

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Through the 4th Dimension Time Barrier to New Production Highs

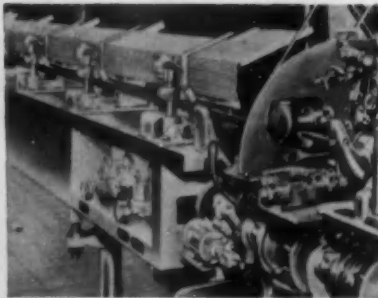
LIPE AML BAR FEED

gears machine production to the steady flow of Time

ALL industrial results are achieved in Time . . . vital 4th dimension that measures output, costs, profit. Shorten the time gap between operations . . . shorten the time when machines are "cutting air" . . . keep machines producing at a steady optimum rate during the fatigue slow-down from 10:30 to noon, and from 3 P.M., till closing time . . . and you are getting 4th Dimension production. Production that is geared to the steady flow of Time.

Lipe AML Bar Feed Produces from 30% to 100% More Output by Eliminating Time Losses . . .

Time losses account for the enormous differences in output among workmen. By eliminating these losses automatically, the Lipe AML Bar Feed boosts overall production from 30% to 100%. That's because stock is fed to the machine independent of the operator. Constant pressure behind the stock assures uniform speed of feed. No feed fingers to fail or mar stock. No multiple feed-outs, even on the longest pieces.



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now for free literature
giving full
details on the Lipe
AML Bar Feed.



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Syracuse 4, N. Y.

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Send me your free booklet.

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Company _____

Street _____

P.O. _____ Zone _____ State _____

CALENDAR

OF COMING SHOWS AND MEETINGS

- AMA Annual Marketing Conference,
Hotel Statler, New York, N. Y.,
Feb. 7-9
- Automotive Accessories Manufacturers of America, annual exposition, Navy Pier, Chicago, Ill. Feb. 7-11
- Society of the Plastics Industry, 10th annual Reinforced Plastics Div. conference, Hotel Statler, Los Angeles, Calif. Feb. 8-10
- Universal Travel & Auto Sports Show, Madison Square Garden, New York, N. Y. Feb. 20-27
- Society of the Plastics Industry of Canada, 13th annual conference, Hotel London, London, Ont.,
Feb. 22-23
- Pacific Automotive Show, Pan-Pacific Auditorium, Los Angeles, Calif. Feb. 24-27
- SAE Golden Anniversary Passenger Car, Body, and Materials Meeting, Sheraton-Cadillac Hotel, Detroit, Mich. March 1-3
- National Association of Corrosion Engineers, 11th annual conference and exhibition, Palmer House, Chicago, Ill. March 7-11
- Geneva Automobile Show, Geneva, Switzerland March 10-20
- SAE Golden Anniversary Production Meeting and Forum, Netherland Plaza Hotel, Cincinnati, O. March 14-16
- ASTE Western Industrial Exposition, Shrine Auditorium and Exposition Hall, Los Angeles, Calif. March 14-15
- AMA Manufacturing Conference, Palmer House, Chicago, Ill.,
March 28-30
- Ninth Western Metal Congress and Exposition, Pan-Pacific Auditorium, Los Angeles, Calif.,
March 28-April 1
- American Power Conference, Sherman Hotel, Chicago, Ill.,
March 30-April 1
- National Fluid Power Association, annual spring meeting, Colorado Springs, Colo. April 5-7
- World Plastics Fair and Trade Exposition, Exposition Park, Los Angeles, Calif. April 6-10
- American Society of Lubrication Engineers, annual meeting and exhibit, Hotel Sherman, Chicago, Ill. April 13-15
- ASME Spring Meeting, Lord Baltimore Hotel, Baltimore, Md.,
April 18-20
- AMA National Packaging Exposition, International Amphitheater, Chicago, Ill. April 18-21
- SAE Golden Anniversary Aeronautics Meeting, Production Forum, and Aircraft Engineering Display, Hotels Statler and McAlpin, New York, N. Y. April 18-21
- International Motor Show, Turin, Italy April 20-May 1
- British Industries Fair, London and Birmingham, England May 2-13
- Fourth International Aviation Trade Show, 69th Regiment Armory, New York, N. Y. May 4-6
- Society of the Plastics Industry, annual meeting and conference, cruise on "Queen of Bermuda,"
May 7-15
- Metal Powder Association, annual meeting and show, Philadelphia, Pa. May 10-12
- Sixth National Materials Handling Exposition, International Amphitheater, Chicago, Ill. May 16-20
- Indianapolis Race, Indianapolis, Ind.,
May 20

EASIER OPERATION FASTER PRODUCTION

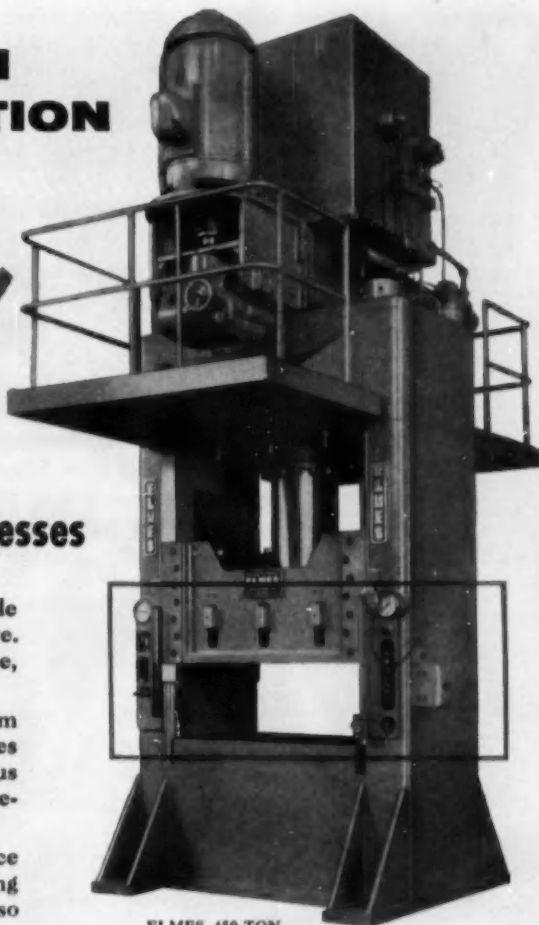
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your thumb!*

with the sensitive, floor-level
Control System on **ELMES** Presses

Elmes simplified controls—all at floor level—have made hydraulic press operation fast, accurate, instantly responsive. Operators of Elmes® Presses have *confidence* in the precise, unfailing control at their command.

Illustrated and described below is the Elmes control system for single-action presses. (Note especially those features which are *exclusively* Elmes.) These same controls, plus additional control features, are provided on Elmes double-action presses.

Elmes engineers have the long and specialized experience that is all-essential for helping you solve your metal-pressing problems to the *best* advantage. And they're ready to do so at all times. For recommendations and cost estimates, see your Elmes Distributor, or write to us direct.



ELMES 450-TON
SINGLE-ACTION DRAWING
AND FORMING PRESS



Left-Hand Control Panel

Oil temperature signal and cut-out. Cut-out is set to stop motor automatically if oil temperature should rise above recommended safe operating level.

Stroke control and speed change adjustments controlled from front of press (**EXCLUSIVE**). This feature permits operator to make adjustments while press is in action and to observe position of the ram while making adjustments.

Right-Hand Control Panel

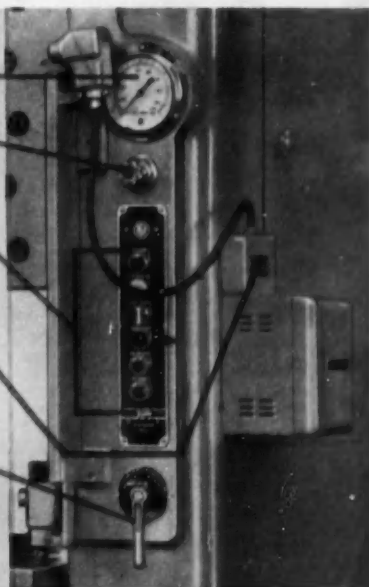
Pressure gauge.

Pressure reversal control.

Pushbuttons for starting, stopping, and reversing press, and selector switch for jog and semi-automatic operation.

Electric eye safety stop control (optional feature).

Manual, hydraulic bleed-off type inching control for die setting (**EXCLUSIVE**). This feature permits control of slide movement to within a few thousandths of an inch.



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Tough grinding jobs?

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high speed precision
grinding heads!



Grinding circular slot using Vulcan's Rotary Table and Magnetic chuck.



Vertical adaptor for Surface Grinders. Grinding small slots



Horizontal application. Grinding a shoulder Punch.

Many seemingly impossible grinding problems have been solved by adapting Vulcanaire to standard machines or by using one of Vulcan's specially designed machines.

On Surface Grinders, merely remove wheel and guard, clamp vertical or horizontal adaptor to machine as illustrated. No belts necessary. For instance, Vulcanaire used in connection with Vulcan's Rotary Table for Surface Grinders permits the grinding of a circular slot.

Adaptors are in stock to fit the spindle of Vertical Milling Machines for grinding contours, holes and slots.

On Internal Grinding Machines Vulcanaire's infinitely controlled speeds furnish the correct surface cutting speed resulting in faster production and micro finish. The adaptor sleeve fits into present housing.

Applied to Jig Boring Machines, Vulcanaire is liked by leading precision manufacturers because its accuracy is guaranteed, producing Vulcanaire jig grinding of large and small parts.

Send us a blue print on your toughest grinding problem. Recommendations and sketches will be returned to you — no obligation.

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Here's How

GITS

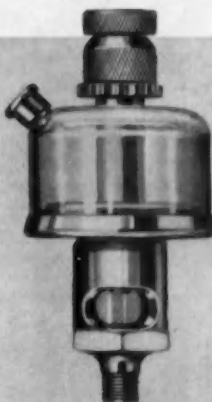
Helps Give

Built-In Low Cost To YOUR Equipment



**OIL
CUPS**

Accurately machined from a solid brass one-piece forging, this oil cup permits safe, dependable application of lubricant at very low cost. Used widely on motors and small machinery requiring side oiling. Style L—No. 1202.



**SIGHT
GRAVITY
FEED
OILERS**

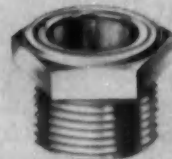
Rate of oil flow regulated by needle valve, directly observed through sight glass in stem.

Shut-off knob does not affect needle valve adjustment. Visible oil supply. Non-breakable. Tops in convenience and dependability, at low cost. Style NFU—No. 3602-A.



**OIL HOLE
COVERS**

This model is designed to fit into a simple drilled hole. Ideal for use on small motors, generators, starters and light machinery—for dependable oil hole protection at moderate cost. Larger sizes frequently used as filler caps on tanks or reservoirs. Style R—No. 305.

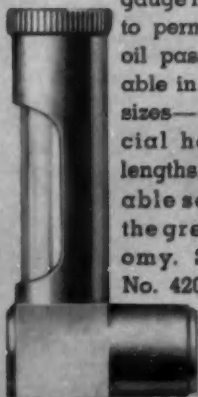


**GEAR
CASE
GAUGES**

This oil gauge plug permits instant checking of oil level within a transmission or gear case. For use where construction permits insertion in tapped hole. A valuable addition to any such equipment—at very low cost. Style BW—No. 4042.

FORGED BRASS GAUGES

Heavily constructed in a single piece from forged brass—this gauge is also drilled to permit generous oil passage. Available in many stock sizes—and in special heights and lengths. For dependable service with the greatest economy. Style FG—No. 4204.



SIGHT GAUGES

For use where rate of oil flow must be regulated to suit changing operating conditions.

Needle valve permits extremely accurate adjustment of oil feed.

Sight glass provides direct observation of rate of oil flow. Accuracy and convenience at a moderate price. Style PF—No. 4290.



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*quickly...easily
...economically*

Compare the time and labor-saving advantages of this simple fastener and you'll soon see why more and more leading manufacturers specify Corbin Self-tightening Hose Clamps for easy, economical hose connections.

Corbin Hose Clamps can be installed quickly and easily...eliminate the need for nuts, bolts or screws...tighten automatically. Made of high quality heat treated spring steel, they resist rust and corrosion...never lose their spring or tension...grip evenly and securely, even when used with irregular castings, tube or hose.

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PRODUCTS



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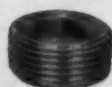
Synthetic rubber extrusions—molded shapes—sheets. Cut parts produced to close tolerances and S.A.E.; A.S.T.M. specifications.



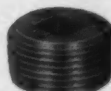
Fellows
**MACHINES AND TOOLS FOR
GEAR PRODUCTION**

The Fellows Gear Shaper Company, Springfield, Vt.

PIPE and AUTOMOTIVE PLUGS and FITTINGS



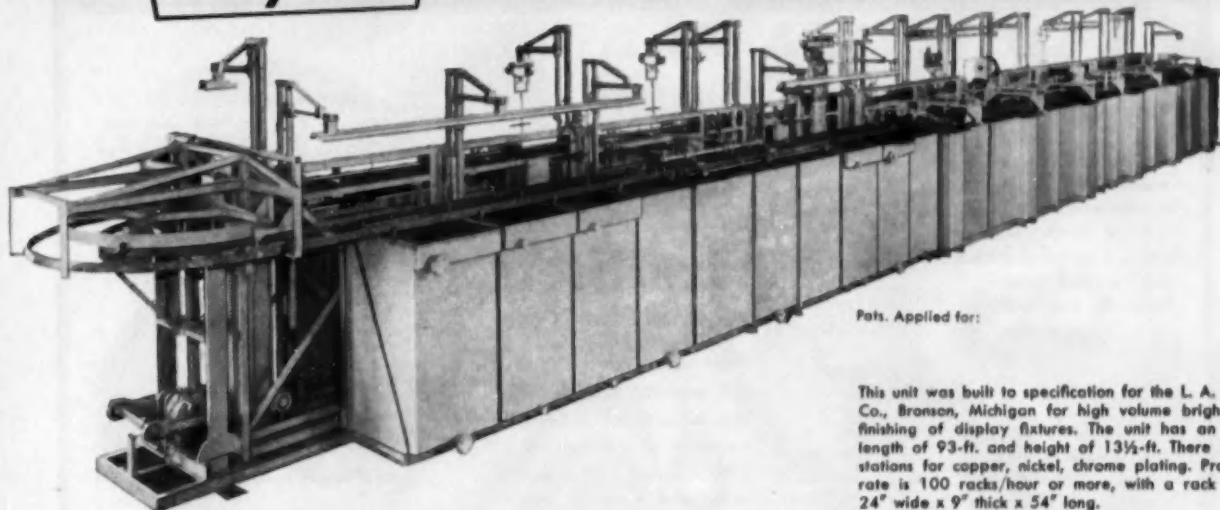
Ferrous & Non-Ferrous
**PITTSBURGH PLUG
AND PRODUCTS CO.**



Pittsburgh 15, Pa.

Evans City, Pa.

ONLY *Wagner* BROTHERS CAN OFFER YOU THIS



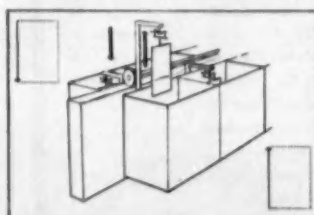
Pats. Applied for:

This unit was built to specification for the L. A. Darling Co., Bronson, Michigan for high volume bright metal finishing of display fixtures. The unit has an overall length of 93-ft. and height of 13½-ft. There are 27 stations for copper, nickel, chrome plating. Production rate is 100 racks/hour or more, with a rack size of 24" wide x 9" thick x 54" long.

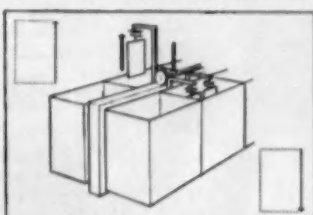
Revolutionary Concept in plating automation...

The Wagner Brothers Automatic is a complete and fully automatic mechanism, incorporating a revolutionary vertical transfer and return type work conveying principle which eliminates elevating superstructure, transfer cams, chains and

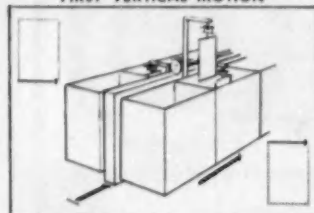
sprockets and hydraulic cylinders above tanks. Many unique design features combine to make this mechanism a smooth operating, perfectly timed unit requiring less than ½ the power of comparably sized units.



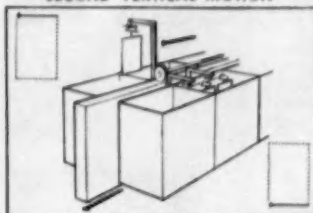
FIRST VERTICAL MOTION



SECOND VERTICAL MOTION



FIRST HORIZONTAL MOTION



SECOND HORIZONTAL MOTION

ADVANTAGES

SMOOTH OPERATION—Operates so smoothly that you can balance a full water glass on the transfer mechanism throughout the entire plating cycle. Obviously such smooth operation will save you time now spent salvaging parts from tanks; dropped there because of the jolting transfer action of ordinary machines. This smooth, positive performance is accomplished because of our hydromotor principle which makes each start and stop gentle as a breeze.

LOW POWER REQUIREMENTS—Powered by one 10 hp motor, this installation uses less than half the power required by comparably-sized units. This is possible because of the almost perfect balance of work load being lifted at one time.

SIMPLE INSTALLATION—Your Wagner Brothers Automatic is delivered to you, either intact or in two or three completely assembled sections, depending upon size. Installation is simply a matter of positioning and leveling.

MINIMUM OF MAINTENANCE—There are few moving parts to wear,

no vibrating parts, no backlash in automation, nor little chance of misalignment. Overload protection is given by a by-pass in the hydraulic pump. All working parts can be reached for adjustment without disassembly.

OTHER PLUS FEATURES—Wagner Brothers Automatics require a minimum of space. The model illustrated uses 54-inch racks and operates under a 13½-ft. ceiling. There are no greased parts or hydraulic fittings over tanks where dripping oil could contaminate solutions. Triple contacts on cathode bars afford consistent, uninterrupted current flow. Automatic heat control system gives simple, foolproof regulation of temperature for accurate results. Centralized lubrication can be provided as an optional feature. Drag and dwell times are easily varied with this unit. **Write for free, illustrated folder.**

In addition to high-volume plating, the Wagner Brothers' Automatic is equally well-suited to anodizing (sulphuric and chromic), phosphate coating, etching, electropolishing, oxide coating.

HOW IT WORKS

All transfer and conveying mechanism is mounted on a reciprocating carriage located between the two rows of tanks. Two basic movements are used to bring parts through the full plating cycle; one forward and reverse straight line horizontal motion and one raising and lowering vertical movement.

Plating racks are attached to work-carriers at the loading station. When the machine is started, lifting arms fixed to the carriage engage the work-carriers being transferred and lift them at all transfer points on one side of the machine, carry them forward to the next station where they are lowered and disengaged from the lifting arm. This sequence is simultaneously produced in reverse on the opposite side so that, when the lifting arms are being lowered on one side, they are raised on the other side.

YOUR PRIMARY SOURCE FOR PLATING AND POLISHING EQUIPMENT AND SUPPLIES

Wagner

BROTHERS, INC.

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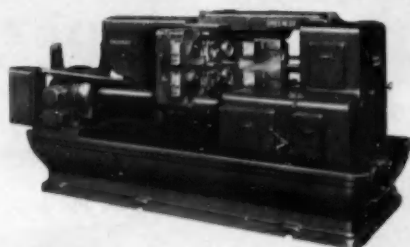
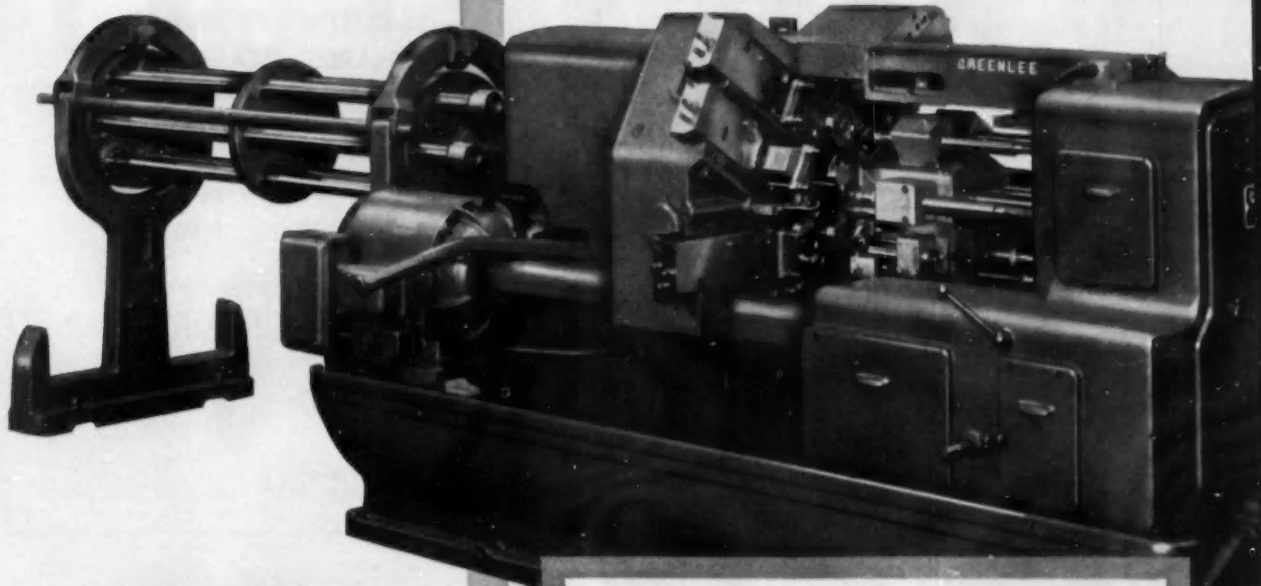
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Zollner Machine Works	3rd Cover



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INCREASE YOUR PRODUCTION...
LOWER YOUR COSTS!

CUT YOUR SET-UP TIME
SPEED-UP DIFFICULT OPERATIONS



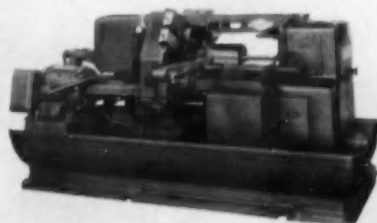
GREENLEE 6-SPINDLE AUTOMATICS SPECIFICATIONS

Rating	1"	1-5/8"	2"
Chuck Capacity, Round.....	1"	1-5/8"	2"
Chuck Capacity, Hexagon..	7/8"	1-13/32"	1-3/4"
Chuck Capacity, Square....	3/4"	1-1/8"	1-7/16"
Stock Feed.....	6-3/16"	8-5/16"	8-5/16"
Turning Length.....	6"	7-1/2"	7-1/2"
Spindle Speed Range.....	225 to 2500	105 to 2175	95 to 1935
Feed Range per Spindle Rev..	.0014 to .0218	.0017 to .0388	.0019 to .043
Motor Horsepower.....	15	20	25
R. P. M.....	1800	1800	1800
Floor space:			
Length with Stock Reel....	17'-6"	17'-3"	17'-3"
Width.....	5'-0"	5'-4"	5'-4"
Height.....	4'-11"	5'-4"	5'-4"
Net Weight in Pounds.....	14,400	17,940	18,150

GREENLEE 4-SPINDLE AUTOMATIC SPECIFICATIONS

Rating	2-5/8"
Chuck Capacity, Round.....	2-5/8"
Chuck Capacity, Hexagon....	2-1/4"
Chuck Capacity, Square.....	1-7/8"
Stock Feed.....	8-3/16"
Turning Length.....	7-1/2"
Spindle Speed Range.....	120 to 1200
Feed Range per Spindle Rev..	.002 to .0458
Motor Horse Power.....	20
R. P. M. of Motor.....	1800
Floor Space:	
Length with Stock Reel.....	17'-3"
Width.....	5'-4"
Height.....	5'-0"
Net Weight in Pounds.....	17,000

GREENLEE 2ND OPERATION AUTOMATIC



Extremely versatile, high-production machines. Parts can be loaded semi-automatically or fully automatically. Incorporates the same basic features... inherent production and operating advantages as the standard 6-Spindle Automatics.

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Incorporated 1945

Builders of Fine Packaging Machines

530 N. 21st Street, Philadelphia 30, Pa.

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designed for the job!

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STEEL LEAF AND
HELPER SPRINGS**

Solving unusual spring and load problems is a 74-year-old success story at TUTHILL. Since 1880, we've been designing and making dependable, alloy-steel springs for cars, trucks, fire-fighters, trailers, multiple-axle jobs, dump trucks, jeeps. Whatever your need, call upon TUTHILL's top caliber skills and materials to provide the right springs — built for your job.

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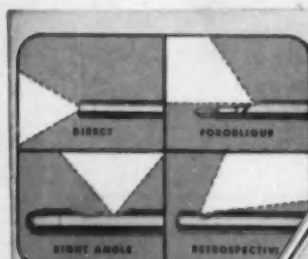
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UNIFORM CLEARANCE AT ALL TEMPERATURES

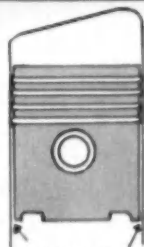
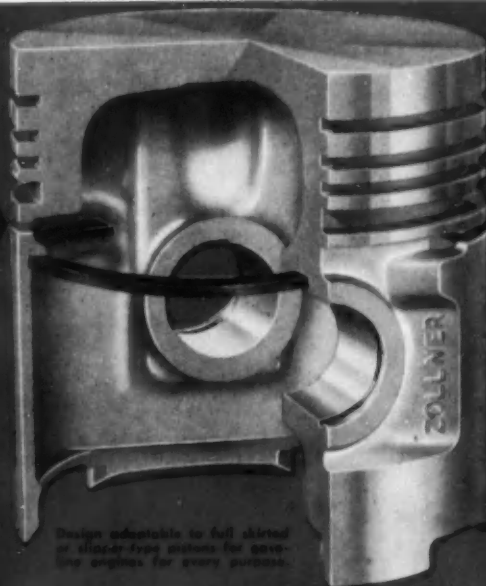
STEEL TENSION MEMBER

Anchored only at pin bosses
and cast in positive contact
with I. D. of piston skirt

Controls Clearance Automatically

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CLEARANCE
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- 3 Steel tension member, with same effective expansion as cylinder, maintains uniform skirt clearance through entire temperature range.
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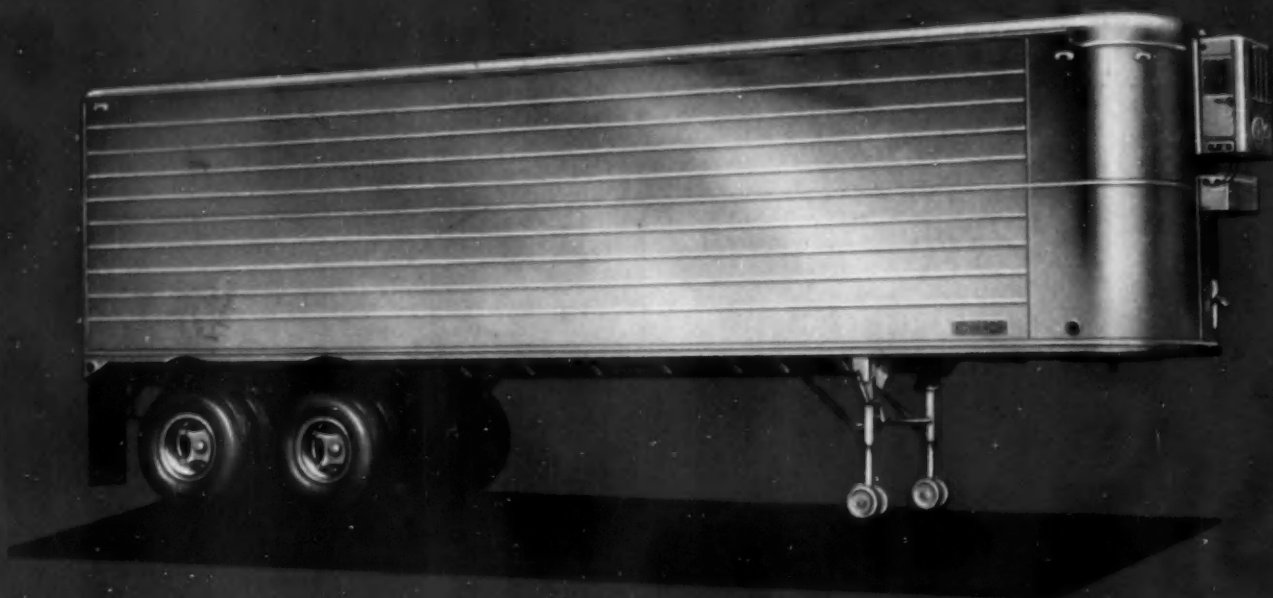
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